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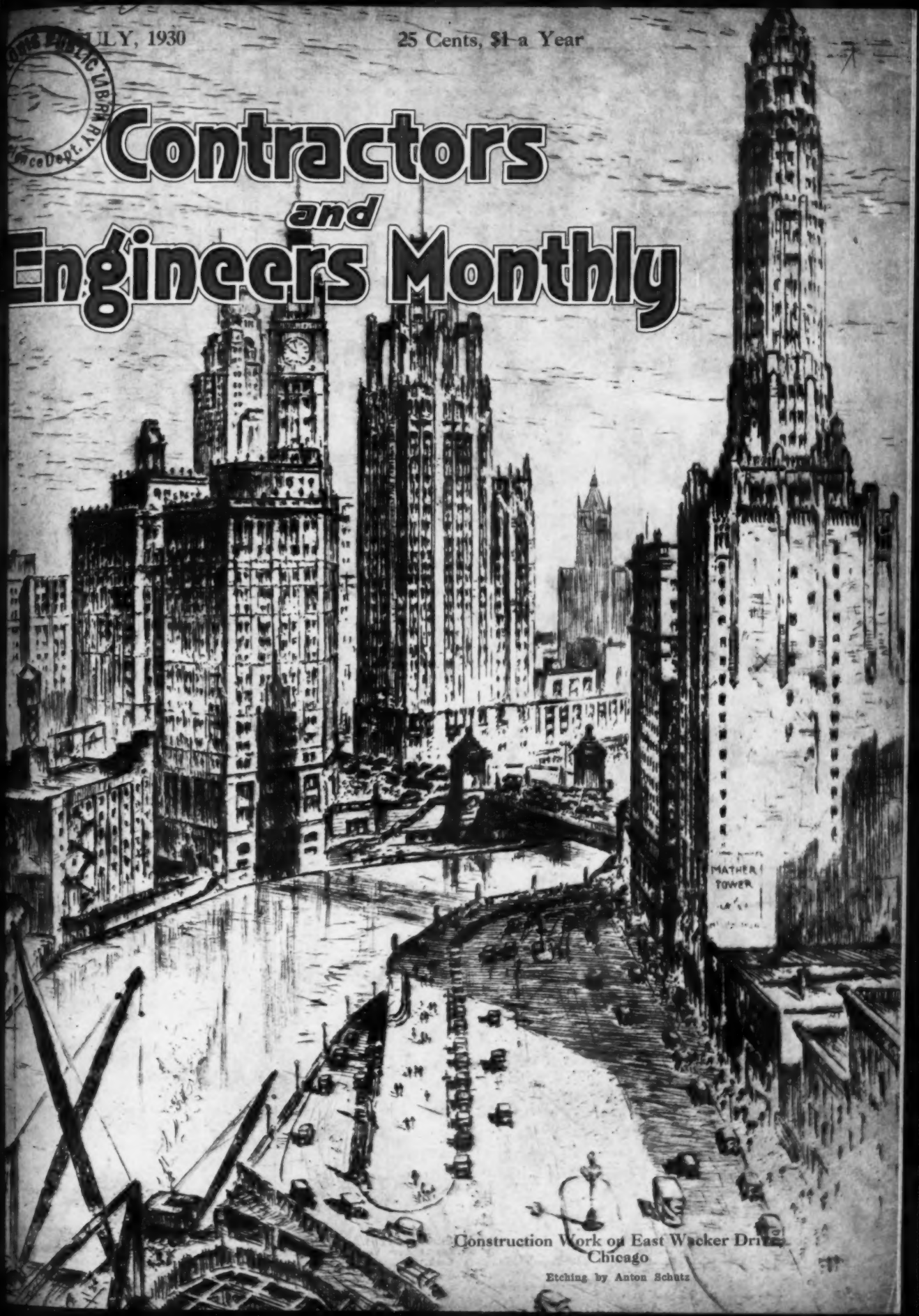

Construction Work on East Wacker Drive, Chicago

Etching by Anton Schutz

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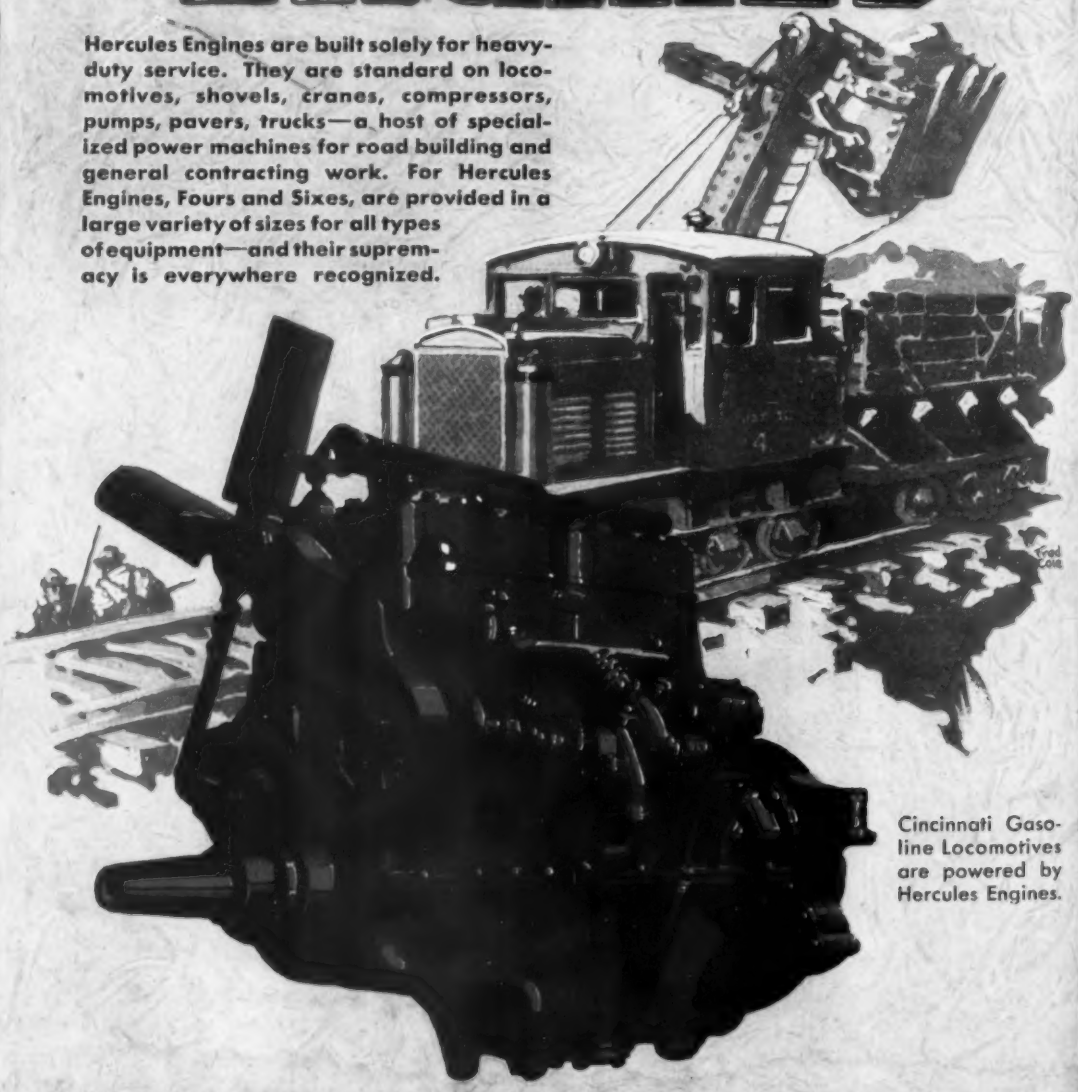

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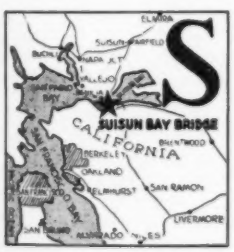
Building Pier 13—

The Deepest Substructure of the Suisun Bay Bridge

By
C. R. Harding

Assistant to President
Southern Pacific Company
San Francisco, Calif.

Construction of the Falsework for Sinking the 81-Foot Diameter Steel Shell Around the Pier Site



STEADY progress marks the construction of the Southern Pacific's $12,000,000 double-track railroad bridge across Suisun Bay in California. Of the eleven piers which will support the main spans of the structure, six have been completed and work is proceeding simultaneously on the remaining five.

On April 12, the last pour was made on Pier 13, on the north side of the channel span, this pier being the deepest one involved in the substructure contract, extending 135 feet below low water and rising 206 feet 6 inches from bed rock to the bridge seat.

A total of about 105,000 cubic yards of concrete and 1,500 tons of reinforcing steel will be required for the construction of the piers. Pier 13 alone contains about 13,500 cubic yards of concrete and 175 tons of steel reinforcement.

The bases of the main piers are to be 38 x 60 feet in plan, except that the two piers 12 and 13 on either side of the channel or lift-span have been made 40 feet instead of 38 feet wide. The sides of the piers rise vertically to Elev.-20, at which height the shaft is started.

The bases and shafts of all piers are heavily reinforced near their outer faces with both horizontal and vertical reinforcement, the steel from the base extending into the shaft above. Similar reinforcement is provided around the faces of all dredging wells.

Method of Sinking

The method employed in constructing the deeper piers is unique and of more than usual interest. This has come to be known as the "sand island" method and, briefly, consists in sinking a steel shell, 81 feet in diameter, around the pier site, and then filling it with sand to approximately low water level. On the artificial island thus formed the steel cutting edge of the pier is laid and riveted together. Steel forms are bolted on top of this and concrete poured to the dimensions of the pier base. When the first 25 feet of concrete have been poured, material is dredged from beneath the pier through open wells, permitting the caisson to sink. Additional concrete is then built up and dredging again resumed, this work proceeding in alternate steps until the pier base has been completed.

Before attempting the final sinking of the caisson, a wooden cofferdam is erected on top of the pier base. Dredging is then resumed and the pier sunk to bed rock, the top of the cofferdam being at all times above high water level.

When rock is reached, the dredging wells are sealed

with concrete and the pier shaft is constructed in the open cofferdam. This method of construction insures placing of the concrete in the dry and under close inspection at all times.

Work on Pier 13, which, as stated above, is the deepest of the main piers, was accomplished in the remarkably short time of 25 weeks and the various steps involved in its construction will be described in greater detail.

CONSTRUCTION OF FALSEWORK

The preliminary step consisted in erecting a system of falsework and building of an octagonal dock about the site of the pier. Eight sets of piles, using eight to nine 140-foot piles to a group, were driven to rock outside the circumference of an 81-foot diameter circle. Each set of piles formed a rectangle 12 feet wide and 15 feet long, the shorter dimension being tangent to the circumference of the circle. Seven additional piles were driven to support a stiff-leg derrick.

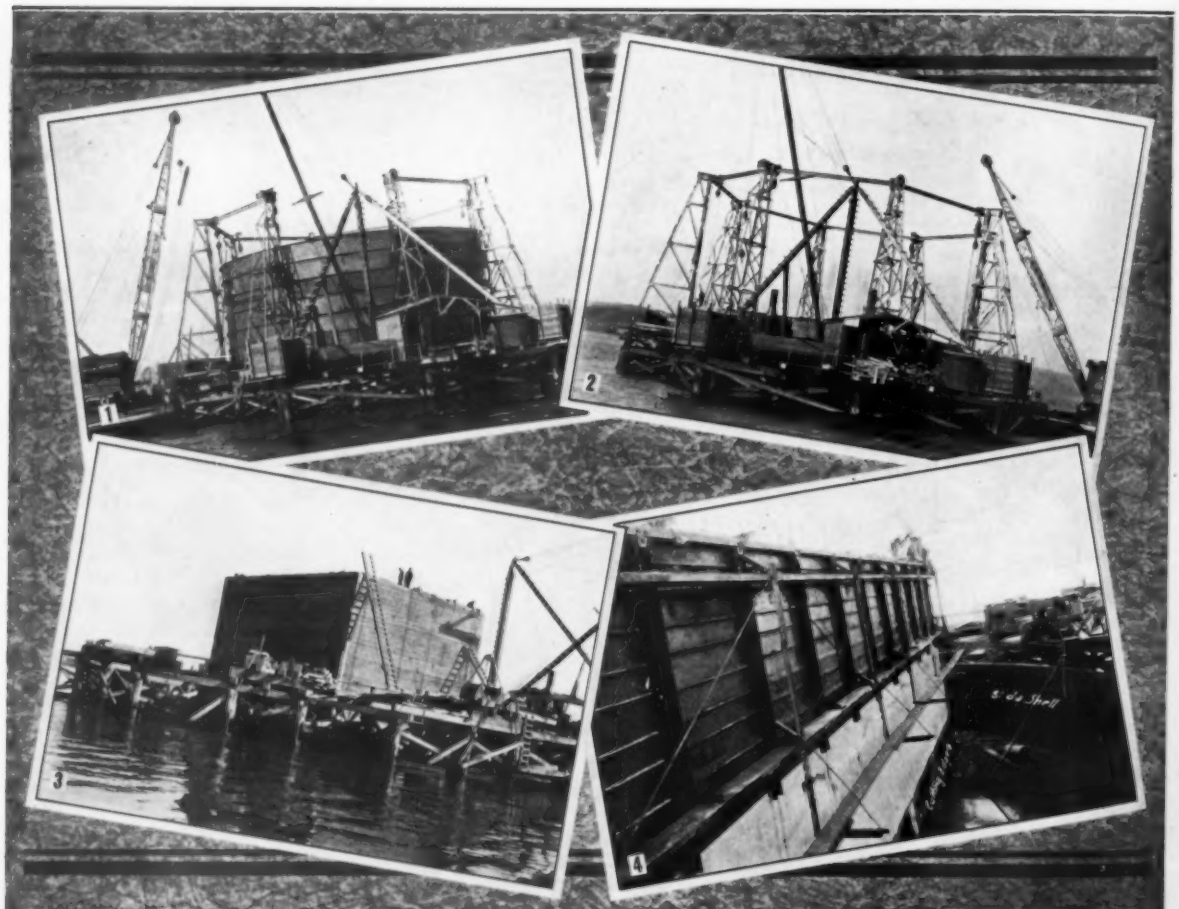
The piles were then capped and braced, forming an octagonal working platform 15 feet wide and about 3½ feet above high water. The distance between the inner sides of this platform across the diameter of the circle was about 85 feet. On top of the platform and above each of the eight sets of piles, grid seats were laid to support the winch frames used in lowering the steel shell.

The winch frames were in the form of steel towers, 44 feet high, a hoisting pulley being suspended from the top of each. These towers were securely anchored to the falsework and were strutted together at their tops.

Serving as a support for the steel shell and also as a means of controlling the lowering operation, movable I-beams were installed within the base of each tower. These beams were so mounted as to permit sliding forward or back radially to the circle. In their initial position, the inner ends of the beams extended within the circumference of the circle, forming a cantilever support for the timber blocking upon which the bottom ring of the steel shell rested during erection.

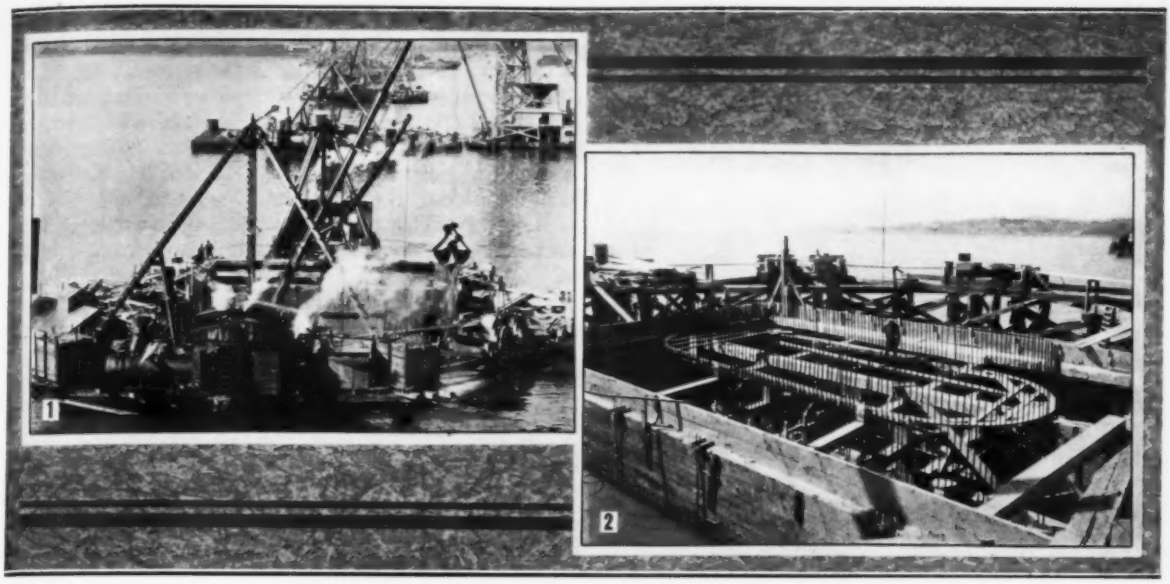
ERECTION AND SINKING OF STEEL SHELL

The shell was brought to the pier site in sections 10 feet high and one-eighth of the circumference in length. Each segment consisted of two ½-inch plates, 5 feet high, riveted together and reinforced horizontally at top, bottom and along the lap, with steel angles. Horizontal field connections were made by bolting together



PREPARING AND SINKING THE CAISSON FOR PIER 13

1. Erecting the first 30-foot section of the 81-foot diameter shell to form the "sand island." 2. Second section of the cylinder shell being lowered. 3. Construction of the reinforced concrete caisson. 4. Attaching the cofferdam to the caisson



SINKING THE COFFERDAM AND BUILDING THE SHAFT

1. *Dredging with a clamshell bucket to sink the cofferdam.* 2. *Construction of the pier shaft within the cofferdam.*

the top and bottom angles of adjacent sections. Vertical connections were made with splice plates on each side of the shell.

The bottom horizontal angle was omitted on the first 10-foot sections, and a reinforcing plate used instead on the inner face of the shell. In addition, six vertical stiffener angles were riveted to the lower half of each bottom section. Interior struts and cable bracing were placed within the cylinder to prevent its distortion during lowering and sinking.

With the completion of 30 feet of shell, the supporting blocking was removed, the movable beams slid back from the shell and the latter lowered until connection could be made between its upper section and the ends of the sliding beams. This was done by moving the beams forward and bolting through connecting lugs to the shell from which bolts had been omitted at suitable points in the vertical field splices.

An additional 30 feet of shell was then added and the entire cylinder again lowered, coming to rest in about 8 feet of mud with the top of the shell a few feet above high water. Before starting to fill with sand the interior bracing was removed and the winch frames dismantled. About 7,000 cubic yards of sand were required to fill the shell and, when completed, the water was pumped down to the elevation of low water and the top of the sand levelled off.

PLACING THE CUTTING EDGE

The cutting edge was then laid down on the sand and riveted together, forming a steel shoe beneath the outer edges of the pier base and also under the partition walls of the dredging wells. For the most part, ⅜-inch web plates and 6 x 6 x ½-inch angles were used in its construction, a total of approximately 98,000 pounds of steel being required for this purpose. At the outer edges of the pier base, the steel shoe was 3½ feet wide at the top, tapered to 6 inches at the bottom, and 4 feet 8 inches deep. Under the partition walls the steel members were 3 feet wide, with vertical sides, and 3 feet 7 inches deep, the bottom being 13 inches above the level of the outer shoe tip.

Before pouring concrete, reinforcing and bonding steel was set and anchored within the steel members of the cutting edge. Steel forms were then set for pouring the first lift of concrete, which was 15 feet high, including material in the shoes. Subsequent lifts were made in 10-foot sections. At the completion of the first 25 feet of concrete, dredging was started through the six open wells which had been left in the center of the caisson. These wells were 10 feet 6 inches x 11 feet 8 inches, separated by walls 6 feet thick.

SINKING OF THE CAISSON

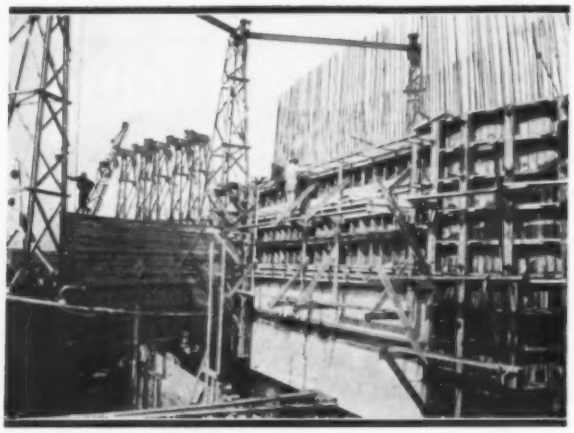
No particular difficulty was experienced in sinking the caisson except for a slight tendency to move from its true position. This was easily controlled by regulating the dredging, removing more material from the wells on one side than on the other and thus bringing the pier back to normal position or to plumb, as required. Concrete was poured during the day and dredging carried on through the night. Each 10-foot pour averaged about 544 cubic yards of concrete.

At Elev.-40 the cutting edge passed from sand into mud with no appreciable change in the sinking. Below the mud a fairly soft blue clay was encountered and this, in turn, was followed by a stiffer clay found at Elev.-80. Sinking through the latter material was slow and it was found necessary to use dynamite to loosen the clay around the cutting edges.

Sinking was continued to Elev.-103.5 before starting construction of the wooden cofferdam, the finished height of the caisson being 112.5 feet, including a 10-foot wall poured around its upper edge. This wall, 2½ feet thick, surrounded the recess left at the top of the pier base for the distributing block.

ERECTION OF COFFERDAM

The next step was the construction of the open cofferdam on top of the caisson. Struts placed against the



Progress of Construction of the Shaft Showing Dismantling of the Steel Shell

walls of the distributing block recess formed the lower part of the cofferdam and were so located as not to interfere with the dredging wells. The cofferdam walls were erected in sections varying from 5 to 10 feet in height and consisted of horizontal layers of 12 x 12-inch treated timbers secured by drift bolts.

Timber joints were adequately caulked and interior strutting placed as the work progressed. The completed cofferdam, 30 feet in height, was anchored to the caisson by means of tie rods. These rods, extending from the top of the cofferdam to the distributing block wall, when tightened, kept the joints tight.

FINAL SINKING OF CAISSON

Upon completion of the cofferdam, dredging was resumed. Sinking proceeded slowly due to the stiff clay and the inability to use more than one rig on account of the height of the cofferdam wall. At Elev. -111 gravel was encountered and, after sinking an additional 3½ feet, fine sand began to enter the dredging wells, filling them to a height of about 40 feet above the cutting edge and creating a 10-foot head of water on the inside of the cofferdam.

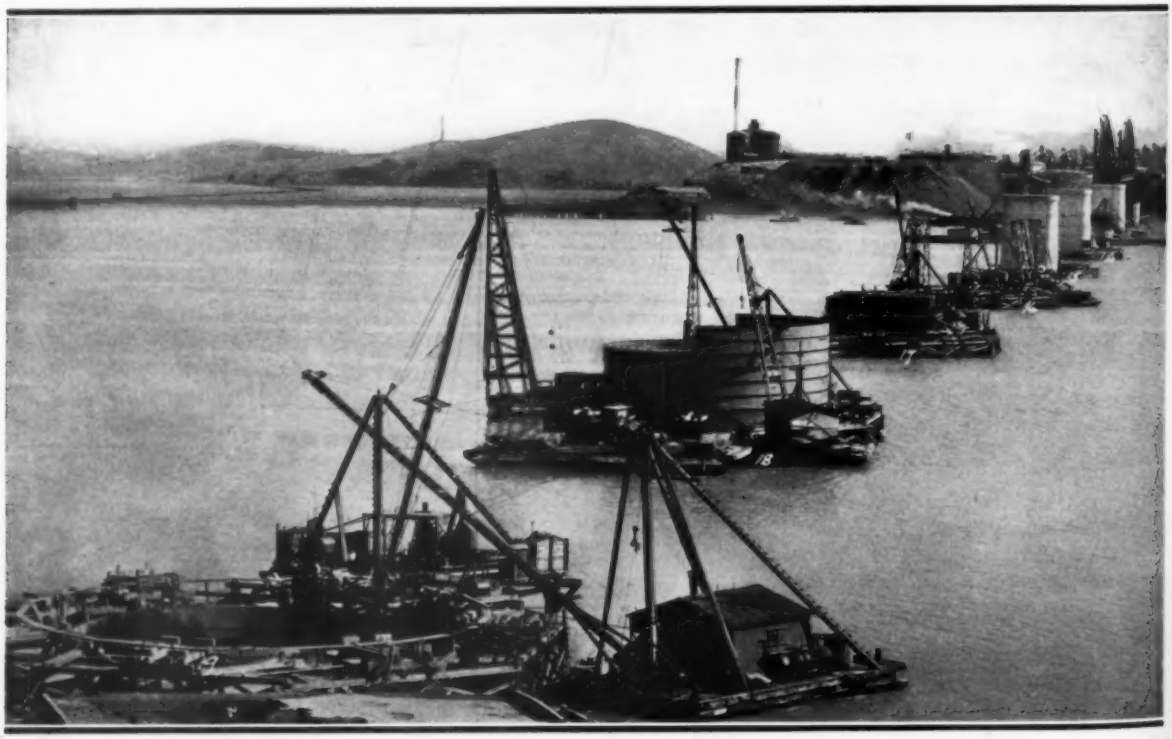
Before dredging could be continued, it was necessary to pump out the water and recaulk some of the joints of the cofferdam. This work was quickly accomplished and, when dredging was again resumed, the material excavated was a mixture of clay and sand. No further trouble was encountered and, at Elev.-121, digging was in gravel, clay and sand. At Elev.-124 a very compact clay was met and jetting was resorted to in order to facilitate sinking.

At Elev.-130, a diver was sent down to inspect the condition of the underlying material. He reported an outcropping of sandstone in the center of one well with about 18 inches of soft material overlying a sandy clay banked around the cutting edge. Hard shale and stiff clay was found under some of the cross walls. Jetting and clamming resulted in additional lowering of the pier, the cutting edge finally coming to rest on hard rock at Elev.-135.

CONSTRUCTION OF PIER SHAFT

Dredging wells were then sealed with tremie concrete to a height of about 100 feet above the cutting edge, after which water was pumped out of the cofferdam and the surface of the concrete cleaned of the slush which had been forced up through the wells.

Setting of reinforcement and placing of distributing block was the next step. This was followed by pouring



View of Pier Construction on the Suisun Bay Bridge as Seen from Army Point on April 4, 1930

of the pier shaft, for which special wooden forms were used on the semicircular ends and steel panel forms on the sides. Timber struts were removed as necessary.

When the shaft had reached Elev. 0, towers were set for removing the steel shell, which was unbolted under water near the mud line, the upper 40 feet being raised and salvaged.

Sheet metal boots for fender protection were installed in the shaft at the proper elevation. The entire pier between low and high water was poured with a 1:2:3 concrete, and two coats of waterproofing were applied between Elev.-10 and Elev.+10.

When the shaft had reached Elev.+30, the cofferdam was loaded down with sheet piling and was subsequently raised and salvaged. Following pouring of the coping and setting of the anchor bolts, all falsework was pulled and removed. Upon removal of the coping forms the pier face was finished with neat cement.

SUMMARY OF WORK

Work on Pier 13 was started on October 21, 1929 and was completed on April 12, 1930, an elapsed time of 173 days, of which 17 days were required for erecting the falsework, 15 days for assembling the steel shell, 13 days for filling the shell with sand, 16 days for assembling the cutting edge and pouring the first 25 feet of concrete, 79 days for sinking (including 3 days spent in constructing the cofferdam), 2 days for sealing the dredging wells, 3 days for pouring the distributing block and 28 days for pouring the shaft.

CONTRACTOR'S EQUIPMENT

Falsework piles were driven from a barge equipped with a 6,000-pound McKiernan-Terry steam hammer. Additional equipment on the barge consisted of a stiff-leg derrick and a Vulcan No. 800-A pile extractor. This was supplemented with other derrick barges, material barges, tenders and tugs.

Concrete mixing was done on a barge equipped with a Blaw-Knox weighing batcher, a Ransome mixer of 2-cubic yard capacity and a wooden hoisting tower 100 feet in height. Sacked cement was transferred from barges to the mixing plant on belt conveyors, while gravel and sand were delivered to material bunkers by clamshell buckets. Fresh water was supplied through a submerged pipe line. The capacity of this plant was 60 cubic yards per hour, based on a 2-minute mix.

ORGANIZATION

The Suisun Bay Bridge is being constructed under the direct supervision of C. R. Harding, Assistant to the President, and W. H. Kirkbride, Engineer of Maintenance of Way and Structures, with the assistance of G. W. Rear, Engineer of Bridges. All field work is in charge of H. I. Benjamin, Assistant Engineer of Bridges. Design of foundation and superstructure was checked by S. A. Roake, Chief Designer.

Ralph Mojeski was consultant in the preliminary study of the project; Moran & Proctor are consulting engineers for foundation work; Waddell & Hardesty are designing the lift span and towers. The substructure is being constructed by Siems, Helmers & Schaffner, Inc., of St. Paul, under the direction of N. F. Helmers, Vice-President; M. F. Clements has been engaged as this concern's consulting engineer. The American Bridge Co. is furnishing and erecting the superstructure.

Solving Construction Problems with a Welding Outfit

INSTALLATION of the heavy massive equipment required on large construction projects or in industrial plants frequently presents unusual problems. In many of these instances the oxy-acetylene process can be of assistance and it is becoming more and more common to find construction crews equipped with oxy-acetylene outfits.

Recently during the construction of a large chemical plant such a problem arose in connection with the installation of a huge piece of equipment made up of several heavy vertical sections. To handle these, two 80-foot gin poles each made from four lengths of 6-inch extra heavy pipe had been erected and stayed with guy wires.

When an attempt was made to lift the first vertical section it became evident that additional guys would be required at a point where no provision had been made for attaching them. At first it seemed that it would be necessary to take down the gin poles, thereby losing time and delaying the erection schedule, but a solution to the problem was found in the welding outfit.

Welders Putting in Place a Steel Band to Hold Additional Guy Wires

The construction superintendent sent for his welding crew and in a very short time two welders were hoisted up to the desired position on the gin pole and were welding on a steel band to carry the additional guys. The other pole was handled in the same way. Soon the additional wires were in place and construction proceeded according to schedule.

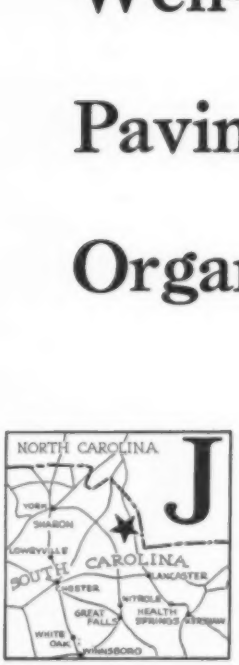
A. R. B. A. Road Show and Convention for 1931

THE 1931 annual road show and convention of the American Road Builders Association has been scheduled for St. Louis, Mo. This meeting next January will bring to that region for the first time in years the annual gathering of highways officials and engineers.

Charles M. Upham, Engineer-Director of the Association, stated that a careful analysis of the road building industry revealed that the Mississippi Valley states are engaged in greater road building effort than in any other section of the country. The geographical location of St. Louis is generally favorable to the majority, and it is expected that the show, which will be held in the Arena, will draw a record attendance.

A Well-Knit Paving Organization

R. G. Lassiter & Company of Raleigh, N. C. Eliminates Extra Labor Without Overload on Any Man or Piece of Equipment



JUST below the North Carolina border, R. G. Lassiter & Co. recently completed a 10.6-mile concrete paving contract for the South Carolina State Highway Department. The contract was originally somewhat longer and was sandwiched between two long contracts, one completed by the Lassiter organization and the other by the Ballenger Paving Co. of Greenville, S. C. The middle contract was split between the two organizations to speed the work as both were well equipped and on the job.

Tractor, Grader and Subgrader Whittle the Fine Grade

The labor for the fine grade was maintained at a maximum of 15 men, while the major part of the work was handled by the machines. A Caterpillar Sixty hauling a Russell grader with 12-foot blade moved all the dirt from the rough grade which had been completed under an earlier contract and placed it on the shoulders. The grade was compacted by a Buffalo-Springfield 10-ton steam roller and planed with a Lakewood subgrader, leaving it ready for the final grade crew at the paver.

The fine grade crew also handled the form setting. The trenches were quickly and expeditiously handled by hand shovelling and the Heltzel steel forms kept set about 800 feet ahead of the paver.

Batching the Dry Aggregates

The stone for the batches was received by freight from the South Carolina Granite Corp. quarry at Blair, S. C., and unloaded to the Johnson bins or to the stockpile by the Northwest crane with a ¾-yard Owen bucket. Sand was received also by freight from the Bonsal Sand Co., of Hamlet, N. C., and unloaded in the same manner.

The average weights for the 6-bag batches were 1,200 pounds of sand and 2,200 pounds of stone. The batches were hauled in 2-batch United trucks, 10 of which were maintained on the job by the hauling contractor, the A. G. Boone Co., Columbia, S. C.

The contractor's crew for the operation of the batcher plant consisted of the craneman, 1 oiler, 3 men in the cars, 1 man weighing, 1 laborer baling cement sacks and the foreman. Volunteer cement was used throughout this contract.

Water Supply for Mixing and Curing

Two Novo pumps were maintained to supply the water for the paver and for the 8-day sprinkling required in the specifications. The water was pumped from convenient creeks and sent along the job in a 2½-inch pipe run along the shoulder, with taps set in every 200 feet. The Rex 27-E paver was supplied with water through a 300-foot hose.

Organization Around the Paver

A man saved here and there and the use of a man for two operations which are not likely to require his attention at the same time, is the secret of the fast working organization that was built up on this job.

The six bags of cement were tossed onto the top of the batches at the cement platform. These were cut by one man as the trucks backed from the Blaw-Knox turntable and were then emptied by the second man. These two men had time to empty the bags of one batch before the truck, under normal operating conditions, backed to the paver to dump the first batch. Then the man who collected the empty bags at the paver climbed on and emptied the bags of the second batch. All the empty bags were stuffed into one bag and taken back by each truck to the batching plant where one man baled them for return to the cement manufacturer.

One man dumped the trucks at the skip and helped generally to speed up the movement of the trucks. An operator and oiler worked on the Rex paver and the oiler was also used to oil the forms just ahead of the pouring. He used a 5-gallon insecticide sprayer with the oil and effected a material saving in the amount of oil used as well as applying it evenly and very rapidly.

A subgrade planer was attached to the paver. This was built of a 12 x 12 timber with blades set flat and running on the forms on steel skids. As a final check a grade check board or template was required by the State specifications, this was operated by the final grade crew of 4 men who shoveled any earth away from the planer and also put the final touches on the grade after the check board had been pulled over the subgrade.

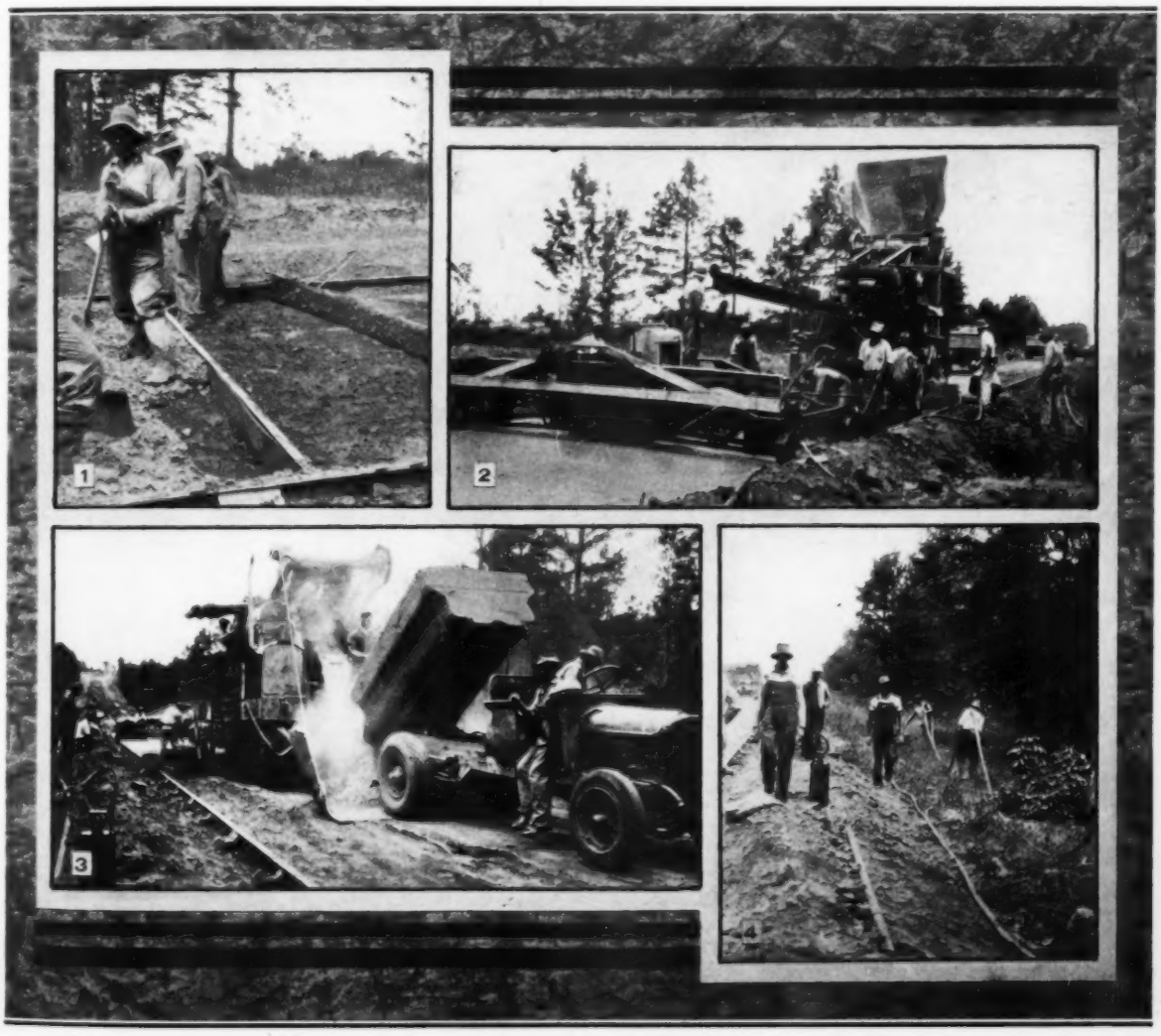
Only three men were used to shovel the concrete, spade along the forms and shovel as needed to the strike off of the Lakewood screed. One man gave his entire attention to the operation of the screed. There were 3 hand finishers who edged around the expansion joints and forms, floated the surface, used the Macon roller to take out any excess water brought to the surface by the screed, and finally belted the surface.

The standard section for the slab on this contract was 7½- 6- 7½-inch with an increased cross-section to 8- 6½- 8-inch over most fills. No reinforcing was used throughout the job except that Truscon center strip was used in the strengthened sections. The center strip was staked every 2½ feet and had 2 dowels 4 feet long and ⅜-inch in diameter in each 10-foot section. The center steel was set by the final grade men behind the paver as were the ½-inch Elastite expansion joints which went in every 40 feet. They were set with a steel guide board cut to the contour of the grade and with a turned over section at the top to hold the expansion joint down when the finishing machine ran over it.

CURING

Two men were used to spread the burlap strips across the pavement as soon as the straight-edging was com-

(*Continued on page 68*)



DETAILS OF THE R. G. LASSITER CONCRETE PAVING JOB NEAR LANCASTER, S. C.

1. The steel guide board used in setting the expansion joints. 2. The Rex 27-E paver and Lakewood screed, mechanical partners in placing and finishing the slab. 3. One of A. G. Boone's fleet of United trucks delivering a batch. 4. Trekking with the paver hose. Note insecticide sprayer, used to oil the forms.

Minimum of Labor

Saved Money for Consolidated Production Corp.

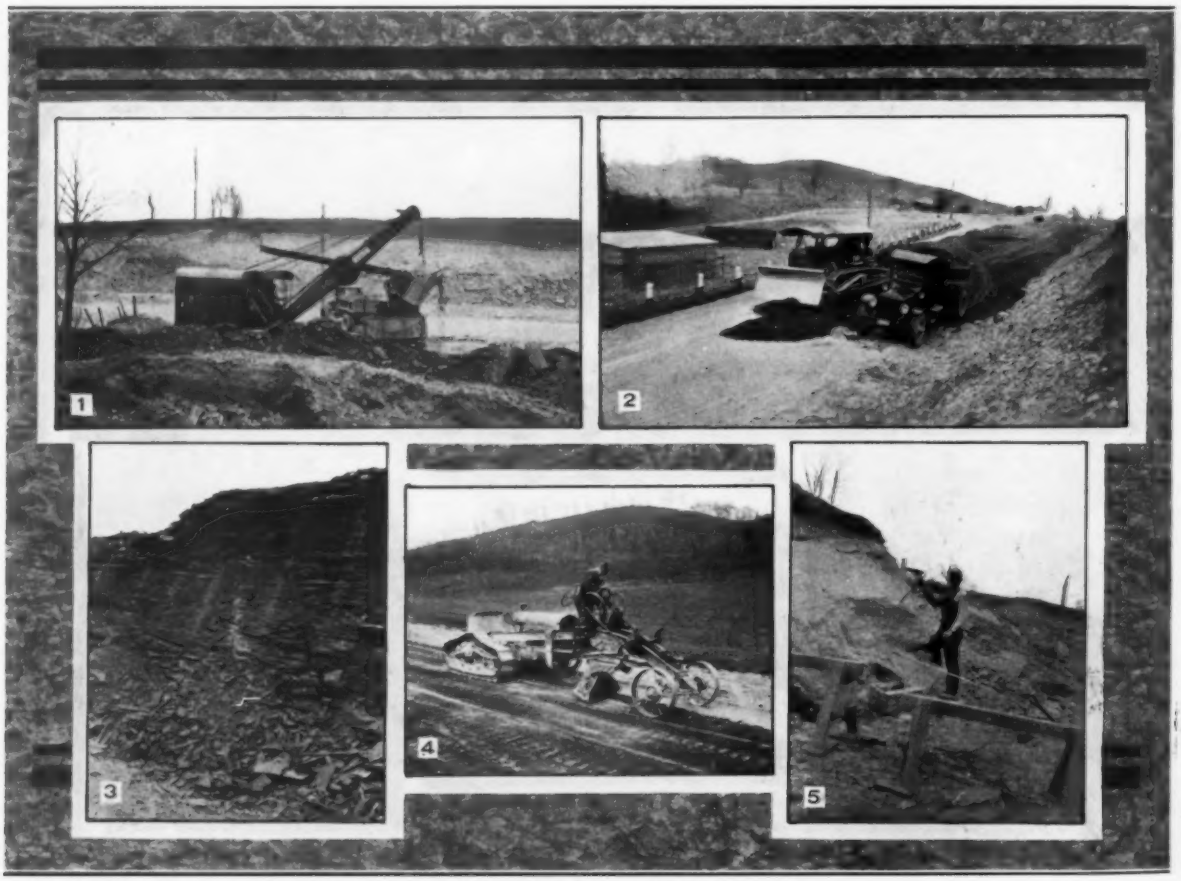
On North Jersey Road. Contractor Used

Complete Mechanical Equipment

MASS production has brought the price of automobiles within the range of Everyman's pocketbook. Mass production with machines doing every possible bit of the work that can be synchronized economically is now being realized in road construction. The Consolidated Production Corp., Hackensack, N. J., contractors for a stretch of 3.664 miles of 20 and 30-foot concrete pavement, 9 inches thick, on New Jersey Route 8, Section 2, between Fredon and Yellow Frame, have proved this conclusively.

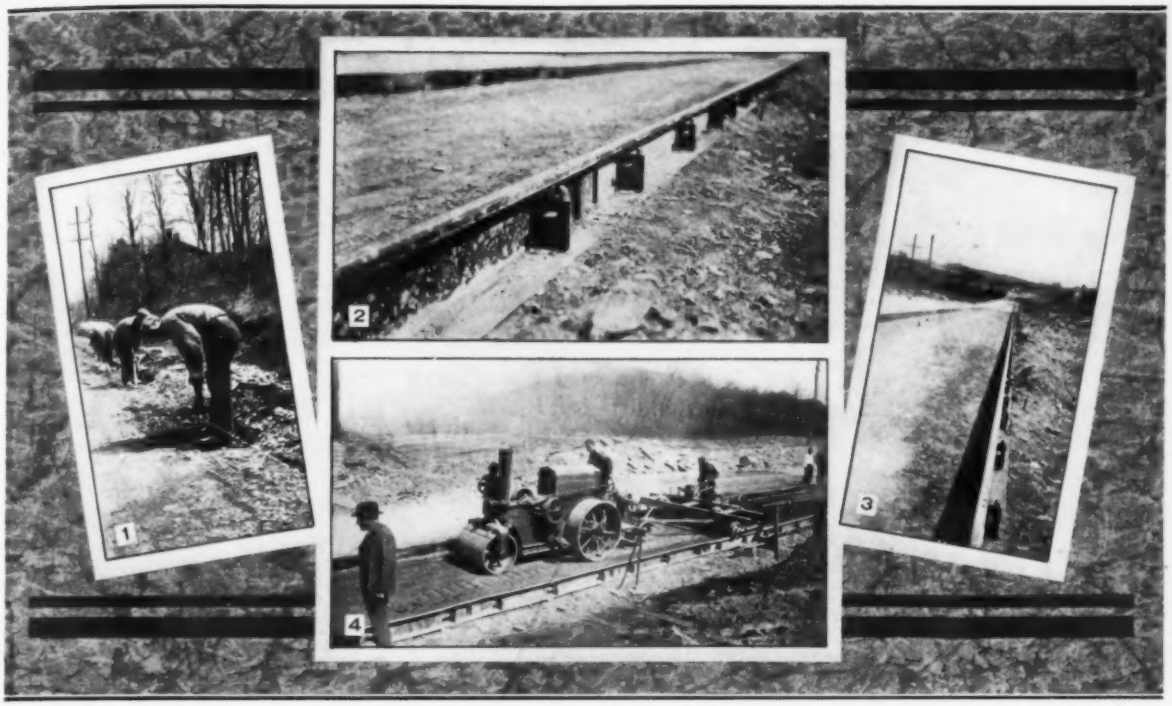
Rough Grading

A Lorain-75 gasoline shovel handled all of the rough grading with its operator, a helper on the shovel, one



GRADING BETWEEN FREDON AND YELLOW FRAME, N. J.

1. Lorain-75 on borrow loading Mack trucks. 2. Laying down a shallow fill in short order. Trucks and tractor operating without interfering with each other. 3. Type of shale met in most of the cuts. 4. A Warco grader finishing off the grade to within 1 inch of final grade. 5. Tamping for a shot in one of the rock cuts.



SETTING FORMS AND PREPARING THE GRADE

1. Four laborers making trench on line for setting forms. 2. A joint without a break—there were no poor joints on this job. 3. Two thousand feet of road forms with the paver at the far end ready to start. 4. Pup roller and Atlantic subgrader cutting to final grade. John Chisholm, Vice President, is watching the Warco grader which had just dropped back to pick up some of the excess dirt planed off by the subgrader.

laborer, the foreman and four Mack trucks with their drivers. A Caterpillar Sixty with a LaPlant-Choate bulldozer quickly smoothed out the piles of dirt on the fills, so that no truck had to drive over an unduly rough fill even on short hauls.

On the rock cuts which were in shale, a Schramm portable compressor operating Chicago-Pneumatic jackhammers cleaned up the drilling in short order, after which the rock was shot with Atlas 20 and 40 per cent gelatin dynamite in holes up to 12 feet in depth.

Good management was obvious in the handling of the trucks as they hauled from borrow or cut to the fills, many of which were only a few feet deep over part of an old right of way. Each truck knew where to dump, spotting the loads in 1, 2, 3 order across the road, systematically dodging the bulldozing tractor and not losing a minute. These Mack trucks were all equipped with Wood hydraulic hoists.

FINE GRADING AND FORM SETTING

The fine grade was shaped up with a Warco grader powered with a McCormick-Deering tractor using a Huber 10-ton roller with scarifier attachment for consolidating.

When work on placing the forms began, hand labor was first in evidence. Five men prepared the trench for the Blaw-Knox 9-inch forms and then dropped back to set them under the direction of the foreman. Immediately following the setting up of the forms, four men with an Atlantic subgrader pulled by a Buffalo-Springfield Pup roller completed the finished grade. Inasmuch as the Consolidated Production Corp., requires that its rough grading crew leave the grade within 1 inch of the final grade for concreting, the work of the four men on fine grades is minimized.

FIVE-MILE DEAD HAUL FOR BATCHES

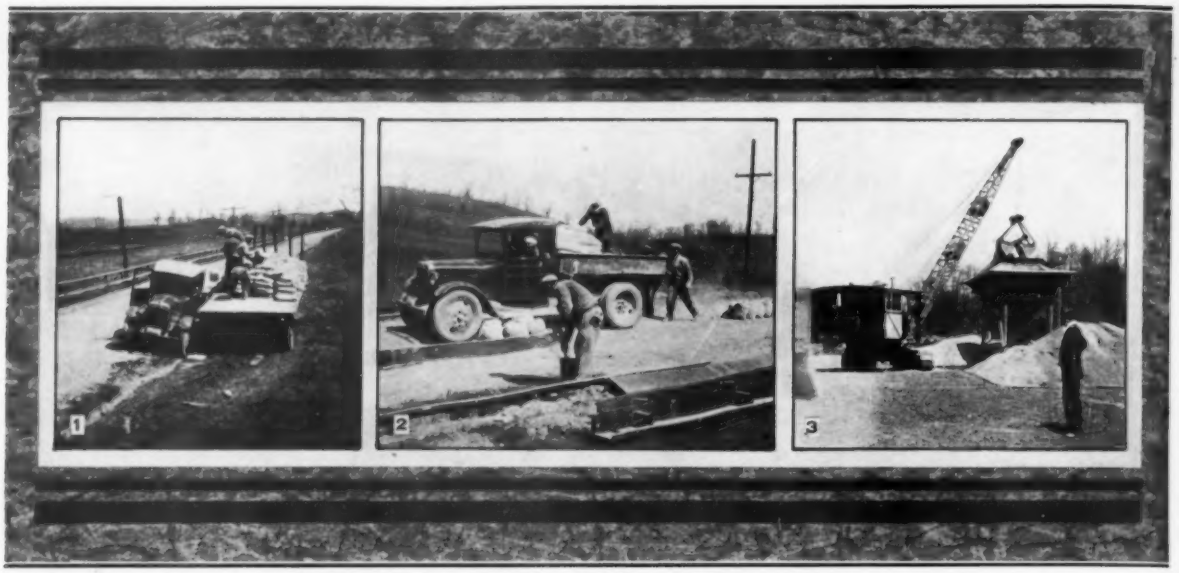
The two sizes of stone for concrete, as well as the sand, were delivered by the Morris County Crushed Stone Co., Dover, N. J., by rail to a spur adjacent to the gas works in Newton, N. J. This is a distance of 5 miles from the near end of the job. A fleet of ten 4-batch Mack trucks equipped with Heil hoists and General tires with dual pneumatics on the rear, handled all of the batch hauling.

The batcher plant consisted of a Koehring crane with a ¾-yard Williams clamshell bucket which filled the three compartments of the Blaw-Knox batcher plant direct from the wood-bottom freight cars or stockpile. The operating crew of the batcher plant consisted of the crane operator, two laborers and a foreman.

The batch trucks drove into the plant, backed under the batcher, received the four batches and swung out to the job. Edison cement was hauled on Freuhauf trailers, 360 bags to the load, from New Village, N. J., a distance of 35 miles. The trailers were parked at one end of the job and the cement in cloth bags handled by a Graham truck which spotted the cement along the forms, hauling back the empty bags on each run and leaving them on one of the trailers.

WATER SUPPLY

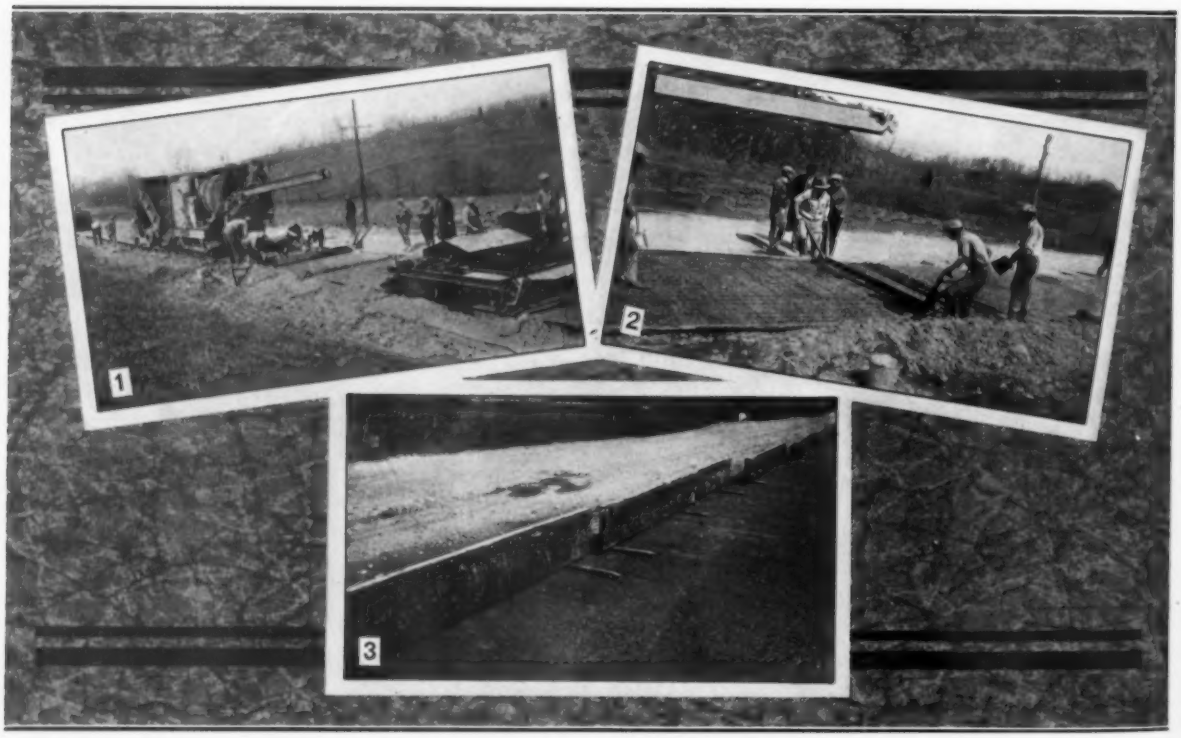
A supply of water satisfactory for concrete mixing



METHODS OF HANDLING CEMENT AND AGGREGATE

1. *Loading the cement shuttle truck from one of the trailers.* 2. *The shuttle truck distributing the cement bags just ahead of the paver.* 3. *The Koehring crane with ¾-yard Williams bucket loading the 3-compartment Blaw-Knox bin*

and for sprinkling the subgrade was secured from a pond at about the middle of the job, water being pumped through a 2-inch line by a C H & E pump. Valves were located about 175 feet apart. A novel method of handling the water to the mixer was used. A shallow trench was cut across the subgrade and a 2-inch pipe laid across from the feeder line. The paver hose was attached to this close to the forms. In this way trucks could haul



POURING THE SLAB

1. *Mack truck with dual pneumatic rear tires, delivering its fourth batch to the skip of the Koehring paver. Puddling crew hard at work and Ord finisher just pulling back for second run over the slab.* 2. *Hand tamping the reinforcing to a firm bed in concrete 2 inches below the top of the forms.* 3. *The slab 20 hours after pouring showing brush marks and straight-edge marks as well as surface darkened by Curcrete. The forms have been pulled and set up neatly on the slab to facilitate removal.*

over the subgrade without damaging the pipe and traffic could be maintained without the constant delays attendant upon shifting the hose. The general utility man who oiled the forms also handled the sprinkling of the subgrade with a short length of garden hose attached to the paver.

CONCRETING ORGANIZATION

In concreting the 10-foot strip, 9 inches deep, the Koehring 27-E paver was run between the forms and the batch trucks turned through a breach in the forms and backed to the paver to deliver the batches. In addition to the paver operator, the concreting crew consisted of one man who dumped the batches into the skip, three men dumping cement from the bags stacked along the forms, two spaders and four pitmen puddling. These four pitmen also struck off the concrete 2 inches below the level of the top of the forms by hand screeds and placed the spot-welded steel fabric mats and corner steel. One man placed the Elastite expansion joint and bulkheads every 33 feet, 4 inches, as specified.

The finishing crew consisted of the operator for the Ord finishing machine and two hand finishers, one of whom also operated the Curcrete outfit for spraying the concrete with an asphalt emulsion. These two men used the hand belt, floats and wire brushes for roughing the straight-edged surface, as well as handling the edging both along the forms and at the expansion joint.

QUANTITIES AND PRICES

Unclassified excavation	25,375 cubic yards	@ $	0.70
Borrow	1,497 cubic yards	@	0.70
9-inch reinforced concrete pavement	47,992 square yards	@	2.75
Plain concrete apron	550 square yards	@	2.75
Preparation of subgrade	47,992 square yards	@	0.10
Improved shoulders	16,199 square yards	@	0.25
Asphaltic oil for shoulders	11,344 gallons	@	0.12
Plain concrete curb	8,950 linear feet	@	0.90
Class D concrete	67 cubic yards	@	15.00
Class C concrete	103.5 cubic yards	@	20.00
Drop inlets, Type B	10 units	@	100.00
Drop inlets, Type D	8 units	@	90.00
Wire rope railing	4,750 linear feet	@	0.85
Reset wire rope railing	1,600 linear feet	@	0.25
18-inch double strength vitrified clay or reinforced concrete pipe	2,134 linear feet	@	2.04
18-inch cast iron pipe	170 linear feet	@	4.00
12-inch reinforced concrete pipe	126 linear feet	@	2.00
18-inch reinforced concrete pipe	269 linear feet	@	2.40
24-inch reinforced concrete pipe	143 linear feet	@	3.75
30-inch reinforced concrete pipe	44 linear feet	@	5.25
Top soiling slopes	23,000 square yards	@	0.10
Fertilizing and seeding slopes	23,000 square yards	@	0.05
Pipes to be removed	466 linear feet	@	1.00
Concrete wall to be removed	12 yards	@	4.00
Extra reinforcement	1,000 pounds	@	0.05
Concrete header	30 linear feet	@	1.00
Reset fence	4,000 linear feet	@	0.25
Sub-base	500 cubic yards	@	2.50
French drain	1,210 linear feet	@	1.25

PERSONNEL

This 3.664-mile reinforced concrete project was built by the Consolidated Production Corp., Hackensack, N. J., under the direction of John Chisholm, Vice President, with Jack Darling as General Foreman and Jack Brennan as Foreman on fine grade. For the New Jersey State Highway Department the work is being carried out under the direction of C. A. Burn, Division Construction Engineer, Newark, N. J., with M. L. Cooper as Resident Engineer.

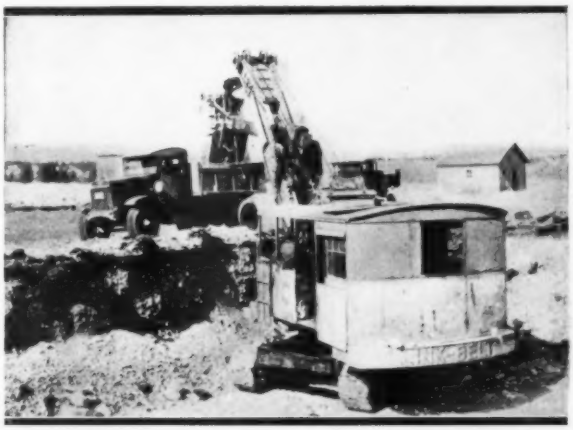
A bonus system developed by the Roberts Paving Co., Salisbury, Md., to minimize breakdowns of machinery is described in "Jim Jones—Protective Operator" in the August issue of CONTRACTORS AND ENGINEERS MONTHLY.

Ghost River Dam Completed

THE Ghost River Dam which impounds the waters of the Bow River in the Canadian Rockies, is now complete. The Ghost River plant has added 36,000 horsepower to the 19,000 horsepower generated at Horseshoe Falls and the 13,000 horsepower at Kananaskis. The dam is ¾-mile in length with a height of 110 feet. A total of 3,045 acres of land has been flooded, forming a new lake, which is used as a pleasure resort.

A force of 500 to 600 men were employed in building the dam. The earth and rock fill required for the completion of the dam amounts to 800,000 cubic yards, and the dam itself required 75,000 cubic yards of concrete. A new highway bridge 600 feet in length and 97 feet above the river forms part of the project.

Sand and deposits for the concrete were found near at hand, and power shovels worked day and night hauling the gravel.



A Link-Belt Crawler Shovel Used by the Foundation Co. of Canada in the Sand and Gravel Pits at the Ghost River Dam, Alberta, Canada

Number of Contractors in U. S. Estimated at 100,000

APPROXIMATELY 175,000 report blanks have already been distributed in the Census of Construction canvass, and according to returns which are not yet complete, it is estimated that the number of contractors and builders who did at least $25,000 worth of construction work last year will range from 75,000 to 100,000.

The Construction Census canvass was conducted entirely by mail until recently, when in all cities of more than 10,000 population, it was turned over to supervisors and enumerators for completion and the elimination of any errors or omissions in the list to which questionnaires were sent.

Both general and subcontracting work are included in the census. The general contracting work includes such construction as building, highway, bridge and culvert, street paving, sewer, gas, water and conduit, dam and reservoir, water works, dredging, river and harbor, levees, railroads, foundations, power plants and similar work, while subcontracting includes carpentering, concreting, electrical, elevator construction, heating and piping, mason, painting and decorating, glass and glazing, pipe covering, plastering, plumbing, roofing, sheet metal work, steel erection, stone work, wrecking, excavating and similar work. For the purpose of this Census, repair work and remodelling are considered on the same basis as new construction, because such work utilizes construction materials and labor.

Controlling Construction Costs

By

L. M. Richardson

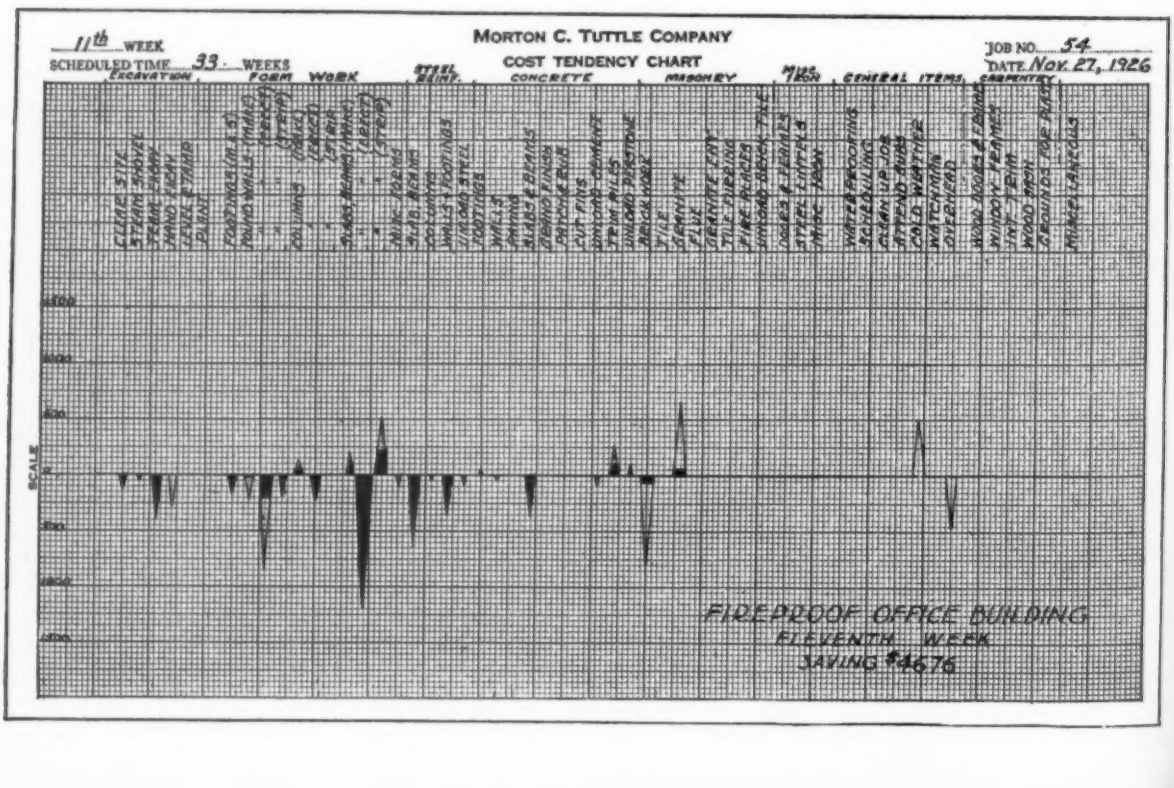
Manager of Construction

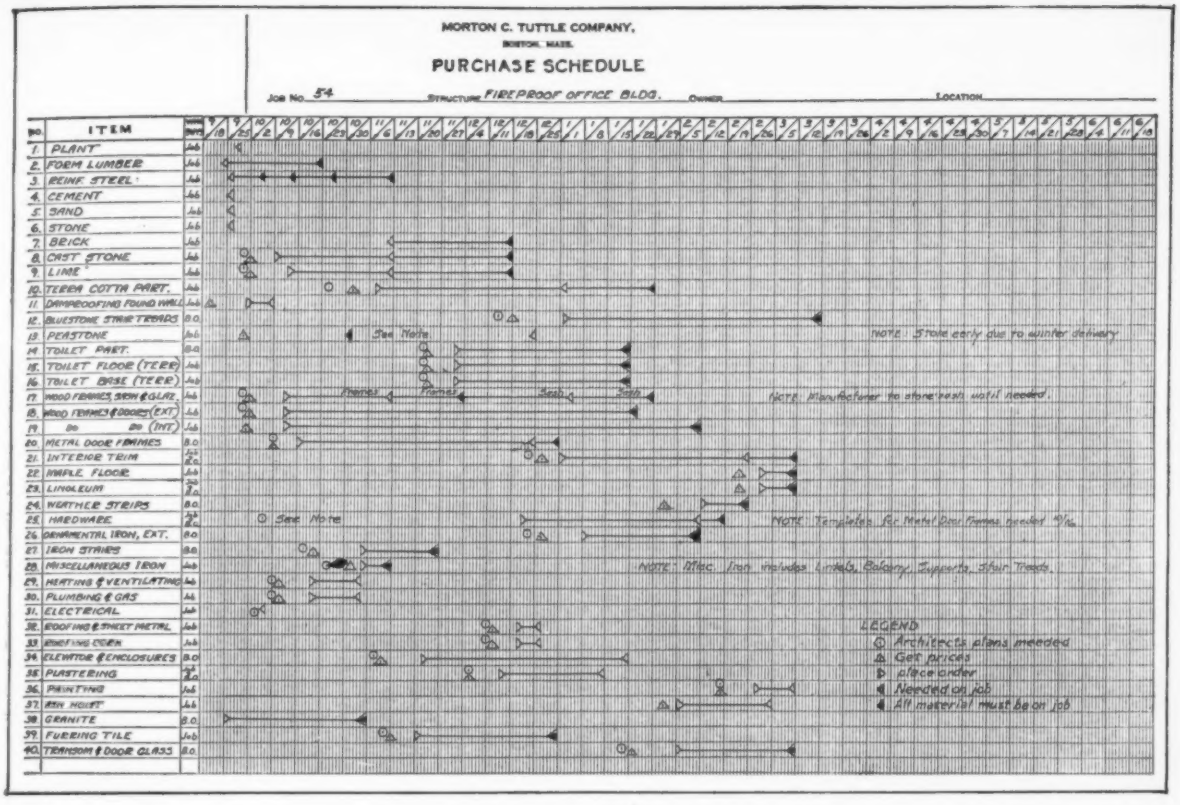
Morton C. Tuttle Co.

Boston, Mass.

THERE are three chief points of interest to the man investing in construction — first, the efficiency of the work as indicated by organization and method of construction; second, the progress in time; and third, the cost of the work. In the case of a contract placed on the basis of price competition, once an award has been made, the method of operation is entirely in the contractor's hands. The matter of time has been specified and is presumed not to concern the owner until the work is completed and the cost is as a matter of choice, entirely in the builder's hands. On this latter point an owner buying a building in competition never knows what the work actually costs. On the other hand, where a contract is placed on a service basis and the builder is selected for his particular ability, while the control of the work and resposibility for it are necessarily in the hands of the builder, it is the owner's privilege to interest himself at all times so far as he may wish in following any phase of the construction.

The contractor operating on a service basis naturally counts as his chief asset the good will of his clients and accordingly he must make every effort to so handle his work that the owner will always find the work proceeding efficiently, with time and cost systematically controlled and periodically recorded. To attain this result, the service builder must pay unusual attention





to the selection of his field forces and to the organization of each contract. He must carefully plan the progress of his work to coordinate the various trades and record progress in such a manner that the time status of the work will at all times be apparent and, what is of greatest importance, he must systematically record and follow the cost aspect of the work from every angle to show at all times the actual costs as compared with the original estimate. Because the interests of the owner are paramount in fact as well as in theory, the cooperative aspects of the relation must be carried out in every phase of the operation. Construction procedure, including the systematic recording of cost and progress must be viewed through the owner's eyes, all records be carried in such manner as to be clear to him rather than in the language of the builder and a full record in clear, understandable shape always be available to him and to the architect who represents him.

The Progress Schedule

The basic secret of successful construction may be given almost in a word. It is that of getting the right men and the right materials in the right quantities at the right place at the right time. And the essence of all this rightness is time. Only a systematic planning of a building operation before the work starts, including a thorough analysis and careful consideration of each operation involved, can assure completion on a definite, pre-arranged date and guarantee a smoothly coordinated procedure from start to finish.

A progress schedule, prepared under the direction of the manager of construction from comprehensive records of past experience is one of the first steps in starting the work, being preceded only by a preliminary survey of local conditions. The schedule should be laid out on a printed form with as many columns as there are weeks in the course of work. A copy of this schedule should be sent to each field office.

It will be noted that the progress schedule illustrated lists the various main divisions of the work in the order of construction. These operations are numbered in the first column. Any scheduled item departing more than a day or two from schedule is indicated by a cross in the third column opposite the item. The fourth column is divided to show the percentage of completion of each item and is of particular value as showing at a glance those items which are completed and the status of each uncompleted item.

The Purchase Schedule

Progress is directly dependent on delivery of material on definite dates, and accordingly the time of delivery of each major item of material must be predetermined. To accomplish this a purchase schedule, in form similar to that of the progress schedule, should be prepared immediately after the progress is prepared. A purchase schedule is herewith produced and is generally self-explanatory.

Job Budget

In order that the field forces may be fully informed as to the expected cost accomplishment on the work, the job office should be furnished with a budget taken directly from the estimate, but made up in two sec-

tions—labor cost and material cost. The budget should be made in preliminary form immediately following the completion of the estimate in order to give a basis for the field cost accounting.

COST STATEMENTS

An efficient cost keeping system is a necessity. Labor costs should be summarized from daily time sheets and transferred to a weekly labor statement. A material cost statement similar in form to the labor statement should be prepared periodically. Both labor and material statements should not only show cost standing to a given date but should also indicate probable final cost based on the going rate of accomplishment.

COST TENDENCY CHART

In order to indicate more quickly and clearly the condition of the work as regards labor costs, it is extremely helpful to plot each week a weekly labor statement on a cost tendency or "lightening" chart. Such a chart is reproduced herewith. The principal emphasis in this chart is on the probable final cost of the work rather than the total expenditure to date. Copies of this chart should be sent each week to the owner and architect, to keep them informed in detail as the work proceeds.

EXTRA WORK

The method of caring for additions and changes under the service type of contract as compared with the usual agreement made on the basis of competitive bids is interesting. Under this type of contract, the architect or owner is given an estimate in detail showing exactly what addition or change involves. When an extra item is authorized it is simply carried along and accounted for in the same way as the rest of the work. In this way the owner pays the exact cost of labor and material plus the contractor's fee, which is usually a pre-determined percentage of cost. A periodic statement of all extras is compiled and given to the architect and owner each week. It is therefore obvious that on the service basis there is no opportunity for making arbitrary demands in connection with extra work, and that one major source of discord is in this way eliminated.

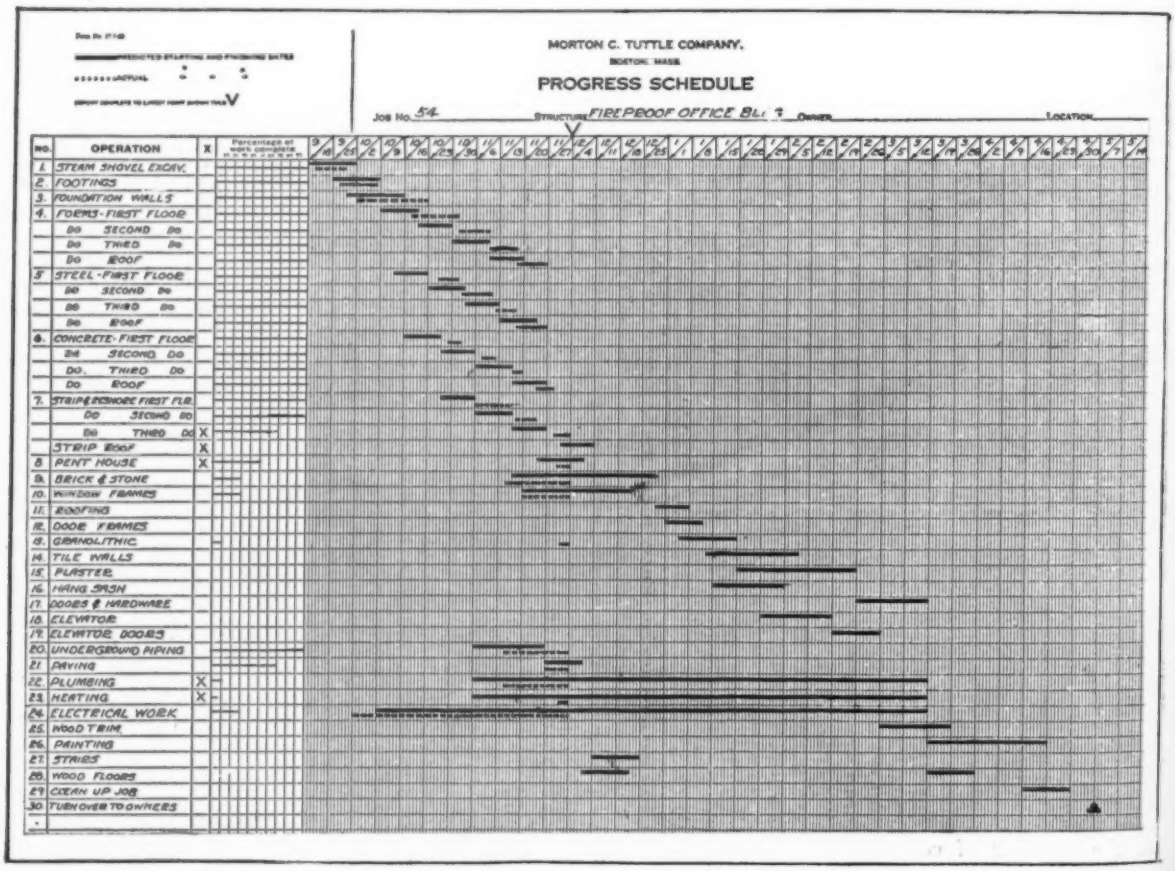
A Well-Knit Paving Organization

(*Continued from page 61*)

plete. The burlap was sprinkled for 24 hours and then removed and brought forward to be used over. From this point the curing was handled by a subcontract. The slab was covered with earth and kept wet for seven more days and then left for three weeks. The contractor then sent a blade grader back and removed the earth to the shoulders.

PERSONNEL

The contract was in charge of L. G. Huffines, Superintendent for R. G. Lassiter & Co., Raleigh, N. C. J. O. Reed was Resident Engineer for the State Highway Department.



No Change in Dirt Moving Methods?

But—

R. B. Davis & Co. of Charlottesville, Va., Shows How It Is Possible to Hustle 500 Yards of Pay Dirt a Day Into Place With 14 Wheelers

The Air Outfit—a Pair of Veterans, a Sullivan Compressor Belt-Driven by a Fordson

SAYS the Old Timer, "There hasn't been any change in dirt handling methods in Northern Virginia in the 20 years since I quit the game. We got 30 cents a yard then and they get 47 cents now, that's all." Wheelers is wheelers, the same as pigs is pigs, but think of the other equipment that has been developed that speeds up the work now and makes possible such good yardage as 500 yards in one day between 6 A. M. and 6:30 P. M. with 14 wheelers with two-up mule teams, taking out 30 minutes for lunch. That is what R. B. Davis & Co., of Charlottesville, Va., did on their job between Centerville and Manassas, Va., dumping 4 wheelers a minute on the fill with a haul of 450 feet. They were not loading a light top soil, either, but a mixture of top soil and a good heavy clay that required a 3-up snatch team on every wheeler to load it.

Why all the talk then about the improvement in dirt handling in Northern Virgina. Well, here's the reason for the speed. In the old days they did not have the versatile and speedy Caterpillar Twenty to pull a plow in the borrow pit now, and in a few minutes be on the fill pulling a grader to make the going easier for the wheelers, and then in another five minutes be pulling out a stump a few hundred feet ahead of the fill. That is one reason for the increased yardage, and another is that the mules are better taken care of now than they used to be. There were 40 mules in the Davis outfit, but in one day there were only 28 out on the wheelers and two 3-up snatch teams. The others were in reserve if one or two showed a sign of lameness or have been a bit overworked the previous day. Every mule out on the job was as full of pep as the best skinner, no shirkers permitted.

A Three Months Job

Work on the contract was started March 4, 1930, and finished before the contract date of June 1. The work called for moving 24,881 yards of excavation at 47 cents a yard, and only 1,100 yards of borrow at 50 cents a yard. The cut and fill were well balanced in the design of the road with the maximum hauls for the wheelers being only 200 yards and the highest fill only 6 feet.

There was no rock item on the job, so the contractor had to handle the 300-foot cut about 5 feet deep in rock as an earth item. An old Sullivan portable compressor was unearthed and hitched up to a Fordson tractor, furnishing plenty of air for the Ingersoll-Rand jack-hammer, which put in the holes with surprising speed.

All the fills were laid down in 12-inch layers, spread by a Stockland 40 grader pulled by the Caterpillar tractor, and then compacted with a 10-ton Austin gas roller or a Case steam roller. The Western wheelers completed the middle 3 miles of the 4.11-mile job first and then cleaned up the two ends. About 50 per cent of the job was over new right of way, and wherever possible the new completed grade was closed to traffic

to prevent the formation of ruts before the gravel surface could be spread. On the section where the old and new rights of way coincided the traffic cut up the grade rather badly, necessitating several trips of the blade grader before it could be kept in shape by the regular maintenance dragging.

DRAINAGE STRUCTURE

There were three box culverts on the job, one 3 x 3 feet, one 4 x 3 feet and one 5 x 3 feet. The culverts were sublet to A. L. Cobb, of Fork Union, Va., who used a crew of 3 carpenters on forms and 7 men in the concrete gang. Class A, or 1 : 2 : 4 concrete for the culverts was placed at $22.00 a yard, and the 5,730 pounds of reinforcing steel at 5 cents a pound. The Class B concrete, 1 : 3 : 6 mix, was used for headers for the pipe culverts at $20.00 a yard. Three sizes of corrugated iron culvert pipe were used, 578 feet of 18-inch at $1.38 per foot, 333 feet of 21-inch at $1.60 per foot, and 168 feet of 27-inch pipe at $2.40 per foot. These prices included the headwalls. A total of 84 yards of Class A concrete was used in the culverts and 40 yards of Class B concrete in the headwalls.

PERSONNEL

S. L. Mitchel, an old-time dirt mover was Superintendent for R. B. Davis & Co. The work was in charge of J. C. Albright, District Engineer for the State Department of Highways, with R. I. Mount as Resident Engineer and W. A. Sims as Inspector.

Construction Robots Big Aid to Realtors

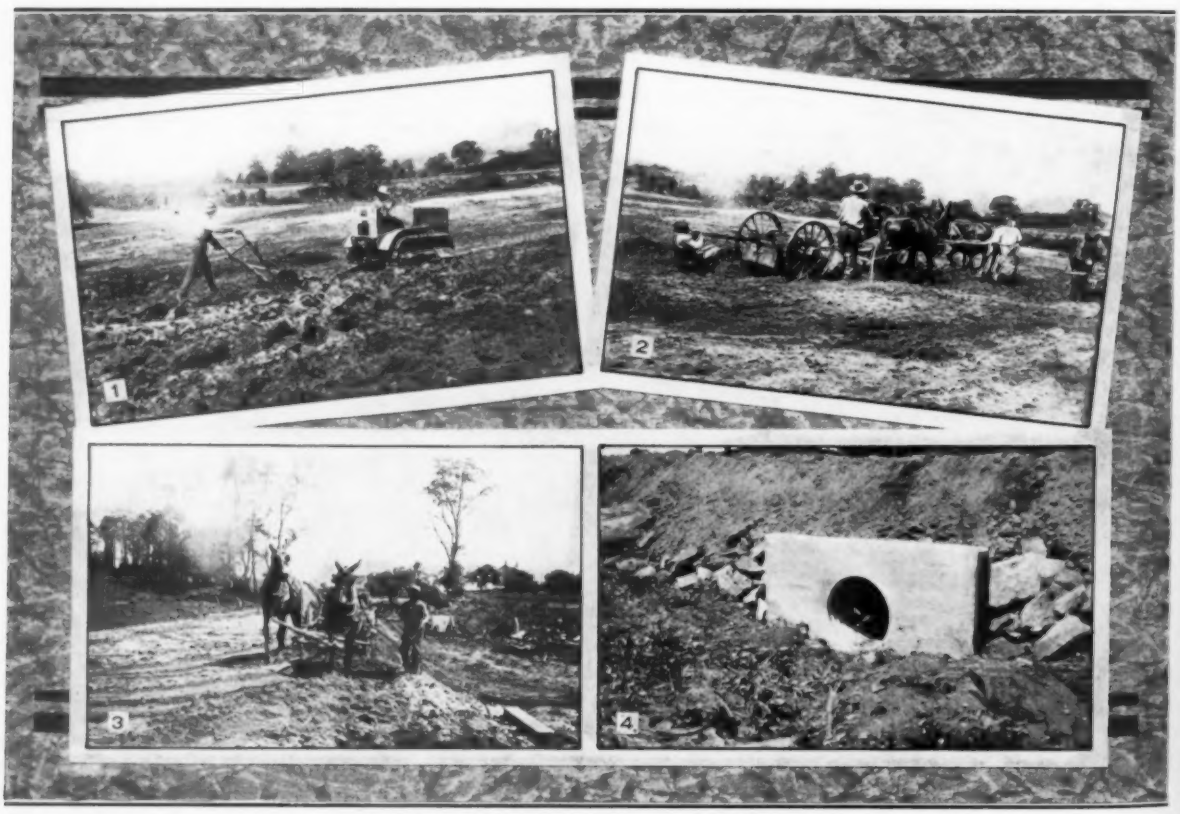
IN a very interesting article in the New York *Sun*, J. E. McGolrick, President, McGolrick Realty Co., New York City, told how construction machinery has boomed suburban developments in the primary process of subdividing, leveling, grading and other improvements.

"In subdividing, recently invented and improved machinery has made possible new economies," declared Mr. McGolrick "The tractor, for instance, used for hauling and moving materials, grading and numerous other purposes, replaces the labor of twenty men and does the work required in one-fifth the time. The 10-ton crawler type of tractor does work that would require fifty men. The gasoline shovel's scope of utility is so wide that it does the work of from ten to a thousand men. The cement mixer replaces from five to fifty men. The scarifier machine, used to rip up old roads, is also a labor and time saving device in a large degree.

"Machines have wrought a new era in building and subdividing because of the Garguantuan tasks they perform, the time they save, and the precision they make possible. In the building industry, labor-saving devices have made spectacular advances. The trenching machine, the gasoline crane, the bucket conveyor, and other devices have gone far to make construction a machine industry instead of a collection of hand trades.

"Because of modern machinery locations which have been swampy, rocky, unkempt, and perhaps desolate wastes, although convenient to the city, have been reclaimed and put on the market with evenly graded streets, sidewalks, and general layout well groomed and attractive for home communities.

"With this in mind, there is no doubt that machinery is spurring the growth of the suburbs. Or, put it this way: Were it not for modern machinery the suburbs would not have been able to grow so rapidly."



DIRT MOVING WITH WHEELED SCRAPERS

1. ***Caterpillar Twenty and plow breaking up ground for the scrapers.*** **2.** ***Loading a Western wheeled scraper using a snatch team.*** **3.** ***Dumping on the edge of the fill.*** **4.** ***A neat culvert head wall on the fill.***

Good-Bye Rakers—

The Steel Dump Board and Lakewood Asphalt Finishing Machine. Note the Extra Heavy Hook on the Dump Board

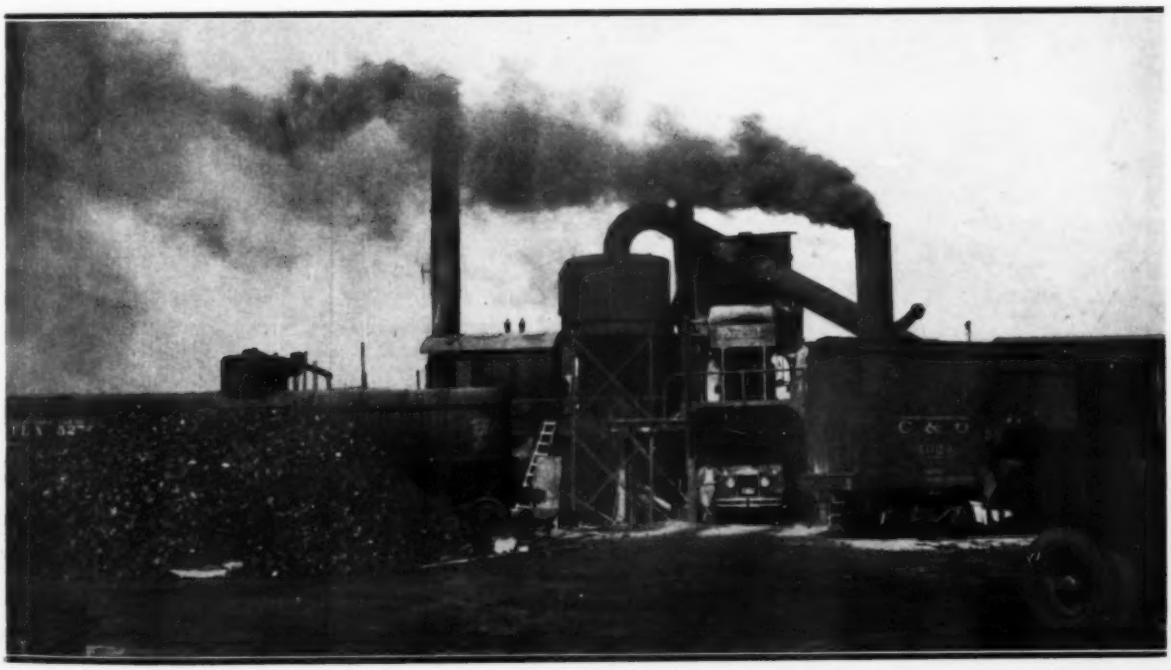
Finishing Machine Speeds Sand-Asphalt Paving

Blythe Bros. Company Laid Average of 1,800 Feet of Base and 2,500 Feet of Top per Working Day

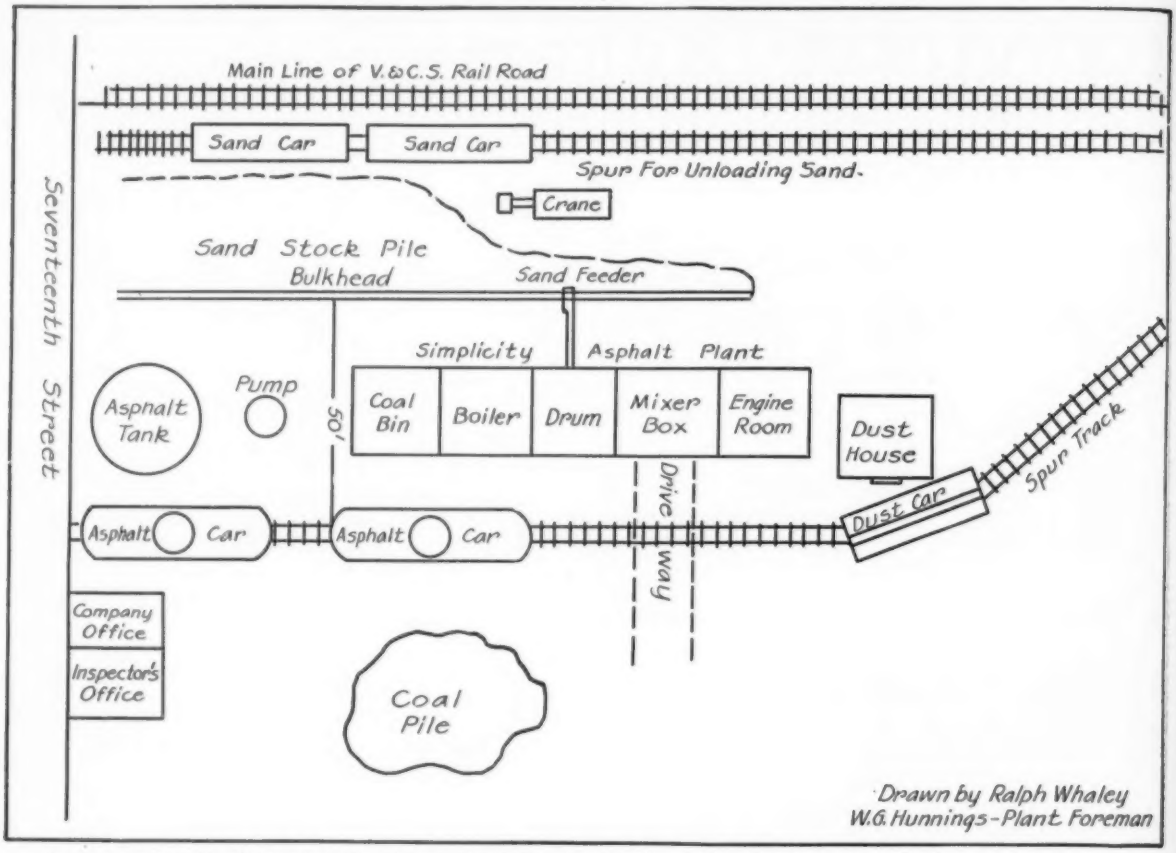
SAND asphalt road construction in North Carolina has reached the point of machine and quantity production. With enough sand to pave the Universe the Tar Heel State began the use of sand and asphalt many years ago and greatly improved its highway system. It remained for some progressive contractors to find that the single screed concrete finishing machine would do the work of the rakers and give a more uniform pavement in quicker time.

11.3 Miles of 18-Foot Pavement

The contract for the construction of 11.3 miles of sand asphalt road 18 feet wide and laid in two courses, a 3-inch base and a 2-inch top, each of Lumberton, N. C., on State Route 201 was awarded to Blythe Bros. Co., Charlotte, N. C. The rough grading had been completed in 1929 under another contract leaving the grade at the elevation of the final grade of the projected sand asphalt paving.



Simplicity Asphalt Plant at Lumberton, N. C., on the Blythe Bros. Contract Showing a Limedust Car at the Right and an Asphalt Tank Car at the Left



Layout of the Simplicity Asphalt Plant and Accessories for the Blythe Bros. Company Sand Asphalt Job Near Lumberton, N. C.

Wood Forms Left in Place

A crew of 23 men and a foreman handled the preparation of the fine grade and the setting of the forms. The surface where it had been compacted by traffic was scarified by a 3-wheel Buffalo-Springfield 12-ton roller which was also used to compact the final grade before paving. A Caterpillar Sixty hauling an Adams leaning wheel grader with a 12-foot blade moved the earth from the 18-foot width to be paved and placed it on the shoulders. For this the contractor received 33 cents a cubic yard under the head of excavation. Borrow, little of which was necessary on this job, was bid at the excavation price. The total excavation amounted to about 30,000 cubic yards. The completed sand asphalt pavement top was bid at $1.16 per square yard, 5 inches thick as compacted. This item amounted to 119,228 square yards.

The wood forms consisting of 2 x 8-inch planks not less than 10 feet in length and purchased by the contractor in random lengths from 10 to 15 feet long were placed 3 inches in the ground and with 5 inches exposed. This gave greater stability to the forms and prevented any of the asphalt working out under the forms. The forms were supported by wooden stakes every 2 feet in accordance with the specifications, but the contractor used more than the required number of stakes to give extra stability to the forms at the super-elevated curves where there was a tendency for the finishing machine to shove the forms on the low side. The stakes were made from 2-foot lengths of 2 x 4's ripped diagonally. The forms and stakes were held firmly together by 40d nails clinched on the outside.

The Asphalt Plant

The Blythe Bros. Co. has a reputation for fine set-ups of their Simplicity asphalt plant but the one used on this job was practically ideal as each one of the materials could be spotted at exactly the best location to give maximum production. The accompanying diagram shows the layout with dimensions and the illustrations give the remainder of the picture.

Sand was received on a spur track at the back of the plant in open top cars and unloaded to stock pile behind a barricade by a Thew crane with a Williams ¾-yard clamshell. The stockpile was covered with a large canvas in sections where the crane was not piling to prevent sudden showers from wetting the sand and slowing up the drying. This precaution saved many hours of time in permitting the normal operating speed of the plant to be continued after a heavy rain over a week-end or a heavy thunder shower. The sand was delivered to the drier bucket elevator by a Simplicity feeder resembling the crawler track of a tractor and operated at a constant speed, the speed of delivery of the sand being regulated by a vertical gate.

The asphalt temperature at the plant was kept at 300 to 350 degrees Fahrenheit and the mix at the same heat. The control was maintained by a Bristol recording thermometer located in front of the man operating the gate admitting sand to the sand drier elevator. The

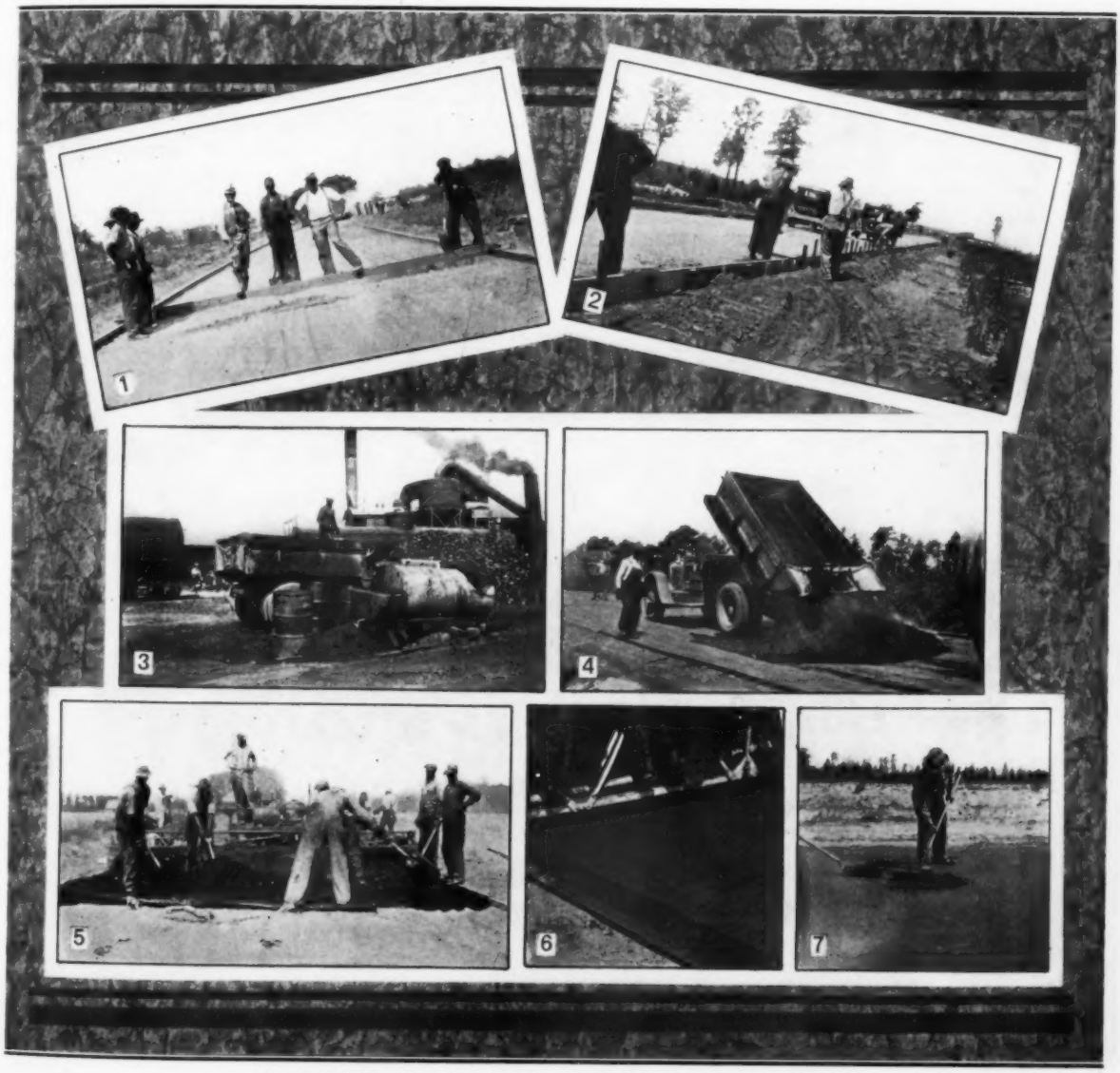
temperatures were taken in the elevator carrying dried sand to the storage bin above the weigh box.

The limestone dust was furnished by the Liberty Limestone Co., from Rocky Point, Va., and was delivered on the material track in box cars and unloaded by hand in wheelbarrows.

The asphalt was from the Charleston, S. C., refineries of the Standard Oil Co. of New Jersey and was shipped in Union tank cars. The tank cars were heated by steam from the main plant and the molten asphalt pumped to a storage tank of 5-tank car capacity by a Kinney asphalt pump through heated lines. An asphalt of 50-60 penetration was specified. The complete crew at the asphalt plant was 13 men distributed as follows: 1 foreman, 1 engineer, 1 day and 1 night fireman, 1 oiler, 1 mixer-box man, 1 weigh-box man, 1 crane operator, 1 helper in car, 2 men to handle limestone dust, 1 coal handler, and 1 ticket man.

The base mixture was composed of 8 per cent asphalt and 92 per cent sand. The top mixture of 10 per cent asphalt, 9½ per cent limestone filler, 80½ per cent of sand; these proportions being changed slightly as sand gradings changed. This, however, was seldom necessary as very uniform sand was used on this job. The material was mixed one minute in the mill and was then dumped into the metal-body truck below. The trucks were oiled with a mixture of kerosene and water as they returned on each trip to the plant.

When the haul was more than 4 miles the batches in the trucks were covered with canvas to retain the heat.



PREPARING THE GRADE AND SPREADING THE HOT MIX

1. The grade board, used to insure an even subgrade for the hot mix. 2. Setting the wood forms. Note the wedge-shaped stakes. 3. Oiling a truck with kerosene and water before taking on the four hot batches. 4. Dumping the batches on the steel dump board. 5. Shoveling the sand and asphalt from the board to the grade. 6. The sand-asphalt as spread by the finishing machine. Note the iron track on the forms and the form of notched joint. 7. Filling a low spot shown up by the straight-edge.

BATCH HAULING BY A SUBCONTRACTOR

The hauling of the hot batches was handled by the Dixon Motor Service Co., of Charlotte, N. C. with a fleet of 14 Autocars equipped with Heil Steel bodies and Heil hoists. The maximum haul was 11 miles and four 1-ton batches were handled per trip. The trucks turned ahead of the forms and backed to the dumping point. The load was dumped on a steel dump board, 12 x 14 feet, which was pulled ahead by the trucks when it was empty. A massive hook was attached to the board by a chain for hitching to the trucks. The contractor had so much trouble with hooks breaking because of the continual heating of the metal by the hot mix that one was made about 3 inches in diameter and this has not broken in a long period of service.

SPREADING THE HOT MIX

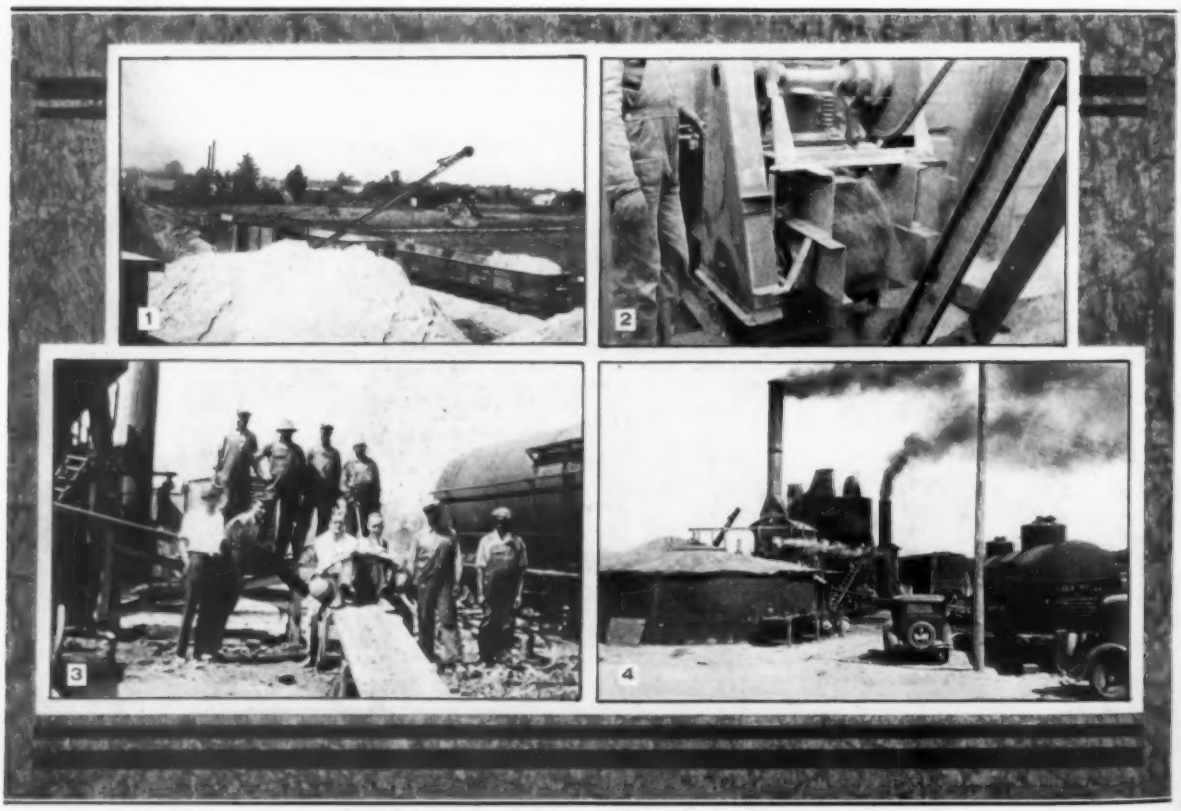
The hot sand asphalt was spread from the sheet metal dumping board by a crew of 10 men who shovelled to the subgrade. They alternated in groups of five to be able to keep up the pace set by the Lakewood single screed finishing machine. No rakers were needed in front of the machine. Two common laborers were used to rake away from the screed if the roll of asphalt became too high. Thus the expert raker who always had a special method, or an extra twist to put on the rake to give a perfectly uniform density to the mix before rolling, has become a thing of the past. There are those, however, who still honestly believe that even with its quantity production that the finishing machine does not give as uniform a pavement.

As soon as the base had cooled after rolling and before there was any chance for it to become dirty through traffic using it, the surface was coated with about 1/16-gallon per square yard of 50-60 penetration asphalt, hot, to act as a binder between the base and top courses. The road was laid with a 1½-inch crown uniform with the base.

The surface was rolled immediately after the spreading by two Buffalo-Springfield 8-ton tandem rollers, one steam and the other a gas roller. Following this the surface was checked with a 10-foot straight-edge for any irregularities and marked with yellow crayon, a circle for low spots and a cross for high spots. The rakers who followed the machine to rake up the edge where the screed did not compact the asphalt next to the forms went back and attended to the low and high spots by gouging out the spot with the rake and either depositing additional material or removing some as needed to correct the irregularity. The top was then rolled until it did not compress more.

Limestone dust was spread on the top with soft brooms, just prior to the final rolling.

The finishing machine was run on angles laid on top of the forms when laying base. These were set with the leg inside the road area. When top was being run the finishing machine ran on strips of steel the width of the top of the form and about 12 feet long with a



OPERATION OF THE SAND-ASPHALT PLANT

1. *Unloading sand from gondola cars to stockpile with Thew crane.* 2. *The Simplicity sand feeder from stockpile to wet sand elevator.* 3. *The entire operating crew of the asphalt plant.* 4. *A view of the Simplicity asphalt plant from the left end, showing the asphalt storage tank at the left and the tank car at the right.*

wedge shaped point at one end and a similar notch at the other end so that the rails fitted securely together. These were nailed to the forms with the 40d nails, and taken up and moved ahead with the machine as there were only two sets of the rails.

OUTPUT AND WORKING HOURS

For the first three weeks of May the output of the plant was 3,155 tons for a 5½-day week, 3,032 tons for a 6-day week, and 2,800 tons for a 4¾-day week. The missing days are accounted for by rain. The average output of base for the entire job was 1,800 feet per day and for top, 2,500 feet, with a plant output of about 500 tons per working day. The working day was from 4 A. M. to 6 P. M. This seems like a very long day but the men at the plant were not called on for any hard labor and the heavy labor on the road was "spelled," as some New Englanders say, between the two shoveling gangs. The men operating the plant reported at 4 and within 15 minutes had the plant in operation as the night fireman kept everything hot during the night so that first batches were arriving at the road about 4.30. The plant shut down active production about 5.30 at night and the road gang kept on until the last load was in place and rolled.

SHOULDERS

The shoulders were made up of the material taken from the grade and replaced with the asphalt. In a few places there was some borrow because of lack of material. The completion of the shoulders was subbed to Harkey Bros., Charlotte, N. C. After the earth was placed it was rolled with a 4-ton roller. A heavier roller was out of the question as the sandy character of the soil would have permitted the sand to flow out from under the rolls and into the ditch and possibly the roller itself might have slid into the ditch.

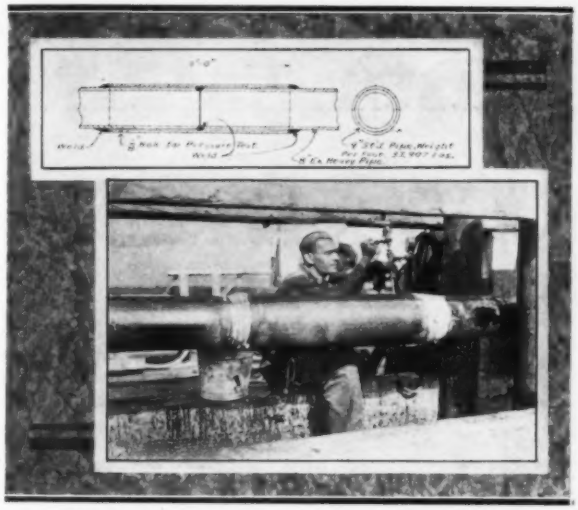
PERSONNEL

E. W. Crowder was Superintendent for Blythe Bros. Co., Charlotte, N. C., the general contractors for the work. C. A. Dixon was in charge of the hauling for the Dixon Motor Service Co., also of Charlotte, N. C., which handled all the batch hauling. For the State Highway Department J. B. Pridgen is District Engineer, J. W. Spruill was Resident Engineer; M. J. Morrison, Plant Inspector; and R. Y. Peck, Roadway Inspector, with offices at Lumberton, N. C.

Methods Employed in Laying an 8-Inch Gas Line Across the Hudson River

OVER a mile of 8-inch gas line was laid across the Hudson River recently from Beacon to Newburgh, N. Y., by the Central Hudson Gas & Electric Co., of Poughkeepsie. This line is of extra heavy pipe designed for an ultimate pressure of 100 pounds per square inch, and at present carrying a pressure of 45 pounds per square inch. All joints were entirely welded by the oxy-acetylene process, the work having been done on a barge and the pipe lowered away into the river bed as the welding progressed and the barge was moved forward.

A type of joint having several interesting features was designed and used for this river crossing. As shown in the sketch it consists of a standard butt weld reinforced by a short piece of 9-inch standard pipe which fits over the butt weld and is welded to the pipe on both sides with fillet welds. This joint stiffens the pipe at the joint against bending stresses which may be very severe at times during the laying of the pipe from the barge. The sleeve also provides an extra factor of safety, as two welds would have to prove defective before leakage could occur at a joint. Possibly the greatest advantage, however, is the time and trouble saved in testing the joints.



THE TYPE OF GAS PIPE JOINT USED ON THE NEWBURGH-BEACON RIVER CROSSING
Above—Diagram of the joint showing butt weld and 9-inch pipe sleeve welded at ends. Below—Testing one of the joints

Each of the 9-inch pipe sleeves were provided with a hole threaded for a ⅛-inch pipe nipple. Because of the fact that an air compressor capable of providing the high test pressure required was not available, compressed nitrogen was used for testing. This was supplied at 1,800 pounds pressure in cylinders similar to oxygen cylinders. It is well understood that oxygen must never under any circumstances be used for testing pressure because oxygen under pressure will react with explosive violence if it comes in contact with oil or grease.

The testing procedure was as follows: A cylinder of compressed nitrogen was connected to the 5/32-inch annular space between the pipe and the sleeve by means of a ⅛-inch pipe, fitted with a valve and pressure gage. The pressure was brought up to 350 pounds per square inch, and soapsuds were painted on the sleeve weld. If the pressure dropped and no leaks in the sleeve weld could be detected this would indicate that the center butt weld was faulty and the pipe would have to be cut and rewelded. This, however, did not happen once during the entire operation. The annular space had a volume of about 1/10-cubic foot and only 9 cylinders of nitrogen were used in testing 163 joints in the crossing. It can readily be seen that a great saving of time and effort was effected by this method of testing as compared to pumping up the whole pipe.

The use of two portable crushers, one for large and the other for small stone, by the contractor, Nello L. Teer, Raleigh, N. C., on a mountain penetration macadam job in North Carolina is described in an article to appear in the August issue of CONTRACTORS AND ENGINEERS MONTHLY. *Convict labor hired from the State was used for most of this work.*

Blasting on Highway Construction Projects

By
H. M. Hamilton

EFFICIENCY and economy in any operation lead to profits and ultimate dividends. Efficiency as it applies to construction projects is achieved through two agencies: namely, field personnel and equipment.

The efficiency of the field personnel depends upon their ability to get capacity production out of the equipment at hand. Machinery for executing grading and drainage projects, like man power, must have a chance to do its work. If the rock to be moved is not blasted to a size which the shovel and hauling equipment can handle, it is impossible to get capacity production out of the shovel. If the compressor is not delivering sufficient air for the drills in operation, there is considerable lost efficiency in the drills. Likewise, if the drilling is not properly done, that is, if holes are not correctly spaced, and are not drilled to the required depth, and if they are not properly loaded with the kind and grade of explosives best adapted to the material, the maximum breakage can not be secured from the blast. A brief analysis of any construction project requiring rock excavation will disclose to the superintendent in charge of the work that the actual output the crew will get per day depends primarily on the drilling and blasting, assuming that the loading and hauling equipment is in A-1 condition capable of maximum production. In

Cleaning Up One Shot and Drilling the Next in a 48-Foot Through Cut in Stratified Blue Limestone on a State Highway Project Near Versailles, Ind.

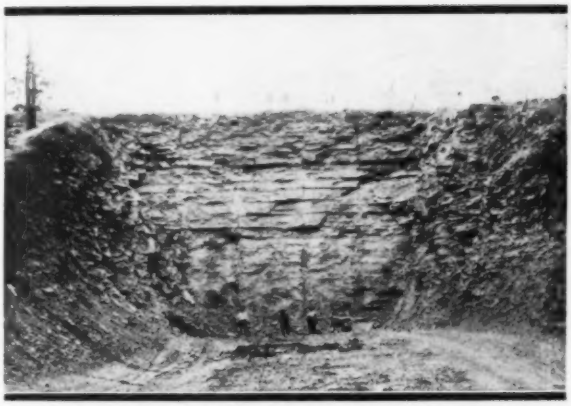
other words, the degree of efficiency realized from the explosives in use is the key to production. The cost of the shovel with its crew and necessary helpers, and of the haulage equipment and men to operate it, is fixed. Therefore, if the rock to be moved is broken to proper size for shovel loading, maximum output may be expected at a low relative cost per cubic yard. On the other hand, if the rock is not properly shot, the production of the shovel and the entire crew is curtailed, with a resultant increase in relative cost per cubic yard.

The phrase "relative cost per cubic yard" is used here with a view to the fact that actual cost per cubic yard properly varies with the kind of rock being blasted and the size of the equipment in use. As pointed out later, certain kinds of stone normally require stronger explosives and heavier charges than others. Obviously, also, material that is to pass through a shovel dipper of ¾-yard capacity must be shot harder than material which is to be handled by a 2½ or 4-yard shovel. Likewise, stone must be drilled closer and shot harder for a No. 5 or No. 6 primary crusher than for a 30-inch or larger crusher. It therefore follows that the smaller capacity equipment entails a higher drilling and shooting cost than the larger equipment by reason of the additional breakage required for preparation.

Spacing, Depth and Diameter of Holes

Since the blasting is the key to maximum yardage, it necessarily follows that the blaster in charge of the shooting should thoroughly understand the explosives he is using and should possess the ability to get the most out of them. A good dynamite man and a high-grade uniform explosive are two important factors in progress and profits on such a project. Before laying out and loading a blast the powder man should study the physical characteristics of the stone and give due consideration to the size shovel in use and whether the material is to be wasted or used for backfill. A sufficient number of holes should be drilled to insure proper breakage for the size shovel in use and these holes should be drilled to a sufficient depth below grade to insure pulling the stone to grade or a little below. The exact depth to which holes should be drilled below grade depends upon whether there is a parting in the rock at grade level. The blaster should spot the holes for the drill crew and see that all holes are drilled to proper depth. The closer together the holes are spaced, the better the distribution of explosives through the rock and therefore the better the breakage and the greater the shovel production. Close spacing is especially important on state highway work where the majority of shovels in use are of the ¾-yard up to 1¼-yard dipper capacity and the stone is usually hauled with tractors, trucks, trailers, wagons and other equipment of similar capacity.

To pull the bottom of any shot, explosives must be tamped in the bottom of the bore hole. Therefore, whatever the diameter of bore hole decided upon, it is important to make sure that drill bits are kept to proper gage to permit getting the calculated proportion of the charge in the bottoms of the holes. The smaller the diameter of the hole, the more important this precaution becomes. If jackhammer drills are used, the finishing bit should leave a hole large enough to permit tamping 1¼-inch dynamite in the bottom. This will sometimes save redrilling and shooting.



THE CUT READY FOR THE SUCCEEDING BLAST

By shooting one row of four holes and cleaning up the rock before the next shot, the cut was pulled clear to the bottom whereas when two rows of holes were tried tight bottom was sometimes left, necessitating extra small shots

In starting a rock cut it is usually advisable to make a shot and load it out before proceeding with the drilling of the next shot, giving particular attention as to whether the stone was pulled to grade so as to enable the shovel to dig it without difficulty. The blaster can thus determine whether holes should be drilled deeper, or closer together, or farther apart and can then make such changes in drilling and loading as he deems necessary to improve conditions, thereby speeding up production and reducing costs.

Kinds and Grades of Dynamite for Blasting Sand Rock and Limestone

As a rule, sand rock gives the contractor more bother and worry than any other material encountered in grading and drainage work, especially on highway projects where cuts are usually not very deep and jackhammer air drills are used. There are different types of sand rock encountered in various parts of the United States, the two most common being the ordinary red sand stone and a grey sand rock which, at a distance, might be mistaken for limestone. The physical properties of red sand stone are such as to render it unsuited for any use in construction; therefore, it is a waste material unless it can be utilized as a fill. It is found in boulder formation, in reasonably thick ledges, in solid formation with apparently no seams, and also in thin stratification.

The trouble frequently experienced in shooting this type of stone is that the explosives make a pot hole or "duck's nest" and do not pull the stone. This is sometimes caused by holes being spaced too far apart, or by holes being underloaded, or by the use of an explosive possessing too high velocity. It is impossible to set out a definite system of drilling and shooting red sand stone because of the varying condition of the material itself. However, experience has taught us that an explosive with the velocity of detonation and strength of quarry gelatin of 40 per cent grade, or under, gives best results. A 50 per cent or 60 per cent dynamite seems to be too quick for most of this red sand stone.

If the rock is to be used for back-fill, Red Cross

A View of the Blast

Extra 30 to 40 per cent, or Du Pont quarry gelatin 30 to 40 per cent, or Extra D is recommended. For a heavy red sand rock, gelatin dynamite is to be preferred because of its high density and also, where the work is wet, because of its water resisting ability. Holes should be drilled fairly close together and staggered. This gives better distribution of explosives; therefore, better breakage.

In certain localities where limestone rock is not available except at an exorbitant price due to long rail shipment, grey sand rock is used as base stone in highway construction. In operations where this material is quarried, crushed and used for this purpose, care should be exercised in spacing the holes so as not to get them too far apart. Usually the grey sand rock is of fine texture and lies in heavy ledges with but few seams. It cuts the gage of drill bits very rapidly and does not shatter or break as easily as limestone. Most economical results may be had by drilling two or three lines of holes, spaced 3 to 5 feet apart and staggered, and loading these holes with 40 per cent quarry gelatin. This system of drilling and loading will produce maximum breakage and put the stone out in reasonably small blocks, which in turn must then be block holed. Experiments have been made in this type of stone with various spacings of holes and with a stronger and quicker explosive in the hope of obtaining better fragmentation in initial shots but without any noticeable improvement in shattering effect. The stronger explosive merely threw the material farther, and incidentally increased the cost of production due to the increase in cost of the 50 or 60 per cent strength over the 40 per cent.

For the block hole work, 30 per cent quarry gelatin in 1 x 8-inch cartridges may be used with excellent results and at a low cost for secondary blasting. The 1-inch sticks permit of drilling smaller holes and the sticks can be cut to any length desired without spilling and losing any of the explosive. This is an advantage which gelatin dynamite has over all other types of explosives.

In estimating the charge of explosives for blasting grey sand rock as compared with limestone, a heavier load is usually required per cubic yard for the former, for the reason that sand rock is apparently lifeless. It does not shatter or respond to the action of explosives or a sledge in the same manner as limestone. While it is somewhat lighter per cubic yard than limestone, still the tenacious character of the rock renders it more difficult to drill and shoot.

Although limestone is the most common stone encountered on construction projects, it nevertheless presents very perplexing problems at times in the matter of shooting. There is no definite rule or formula that can be used in determining the best drilling practice or proper kind and quantity of explosives to use. If this were possible, anyone who followed the formula worked out for the drilling and loading could do the work without any previous experience; all that would be necessary would be to follow directions literally. This is impracticable in using explosives. Experience and good judgment coupled with high grade explosives are the essential requisites.

There are many important factors requiring consideration in shooting limestone, all of which when put together govern the spacing of the holes, the kind, grade and quantity of explosives to use. For instance, under a given set of conditions, a half pound of explosives—40 per cent or 60 per cent dynamite—per cubic yard of stone in place will produce satisfactory results; whereas there are other and more difficult conditions where the quantity of explosives must be increased to three-quarters of a pound, and perhaps more, per cubic yard in order to obtain the desired breakage for shovel handling.

The weight of limestone in the solid runs fairly uniform, from 163 to 170 pounds per cubic foot, but it is the formation of the stone, the presence or absence of seams, texture of the stone, and its responsiveness to the action of explosives, and finally the handling equipment available, that must be reckoned with in drilling and shooting to obtain the desired results and at a satisfactory cost. Each project presents its individual problems and peculiarities and must be dealt with accordingly.

Deposits are encountered, such as stratified, easy breaking stone, where a low density or bulky explosive, such as one of the Extras, is best adapted. Then there is stone fairly hard to break, less stratified, where 40 per cent Extra or 40 per cent quarry gelatin is best suited. Going a step further, into the hard blue and grey limestone with heavy thick ledges, quarry gelatin of 60 per cent strength is best adapted by reason of its high density and high velocity, and therefore, greater shattering power.

Frequently in a side hill cut all of the material is to be wasted. It is then to the advantage of the contractor to shoot all of the material, or as much of it as possible, over the cliff to save handling. Very satisfactory results may be had by the well drill method of shooting or if the cut is not more than 30 feet or so deep, the new high-speed piston drills may be used to drill holes which will finish about 2½ inches in diameter at the bottom. These holes may be sprung if deemed necessary. Shots of this character should be loaded heavy for maximum results.

To waste material, a slow propelling explosive is the logical type. Du Pont R. R. P. and Du Pont B. blasting powder of R. R. granulation are particularly suited to such work. However, neither of these explosives is waterproof. The R. R. P. will work in damp holes, if

not permitted to remain too long. The blasting powder must be used in dry holes or be protected from moisture. For blasting red sand rock good results have been obtained by loading 40 per cent quarry gelatin in the bottoms of holes and 5 per cent R. R. P. on top, the load being divided in the ratio of about 40 per cent of gelatin and 60 per cent of R. R. P. The gelatin, being stronger and quicker, breaks the stone loose and the R. R. P., being slower and having more of a heaving action, pushes it out.

THE CIRCUIT TESTER AS A SAVER OF TIME AND MONEY

On all work where electric blasting caps are used, the circuit tester (as the so-called galvanometer is now properly designated) should always be on the job. There is no way of determining how much property damage is avoided or how many lives are saved annually by the use of the circuit tester. It is not even possible to calculate how much money this small instrument saves and makes for the contractor. We do know, however, that it effects a great saving in time in getting shots off so that the shovel crew and other labor are idle only a few minutes, whereas without such an instrument to test electric detonators and the wiring circuit, the entire force is frequently tied up for hours at a time by misfired holes and when the shovel does get to work it is likely to be delayed by the hard digging resulting from a poor shot.

Electric blasting caps should be tested with the circuit tester before making primers. They should be tested again after the hole is loaded to determine whether wires have been broken in tamping. After the entire shot is loaded and the detonators are connected in series for firing with a blasting machine, the entire series should be tested. Finally, after the series is connected to the leading wires, the entire circuit should be tested before attaching the leading wires to the blasting machine. If the blaster will persistently follow this practice, he will have little if any trouble with his shots.

UNDERLOADING A BLASTING MACHINE AS PRECAUTION FOR AVOIDING MISFIRES

The blaster should beware of overloading any hand-operated machine. If the machine in use is of 50-hole capacity, the capacity is 50 holes when the machine is new and conditions are favorable. It is a wise precaution not to put more than 40 electric blasting caps on a 50-hole machine at any time. It is better to hook up 40 holes and pull them all rather than hook up 50 or 60 and pull part of them. In a shot where part of the holes fail, a hazardous condition is created for the shovel crew in that unexploded dynamite with caps attached is mixed with the stone and may cause a serious accident. Aside from the danger involved, the holes that fail to explode leave their burden unbroken and naturally this retards production of the shovel crew and in many cases redrilling and reshooting become necessary, thereby building up more expense on the job.

STEPS FOR SAFEGUARDING PROPERTY AND TRAFFIC

The fact that highway blasting must frequently be carried on in close proximity to buildings and to telegraph, telephone and power lines and that roads are often open to traffic while work is in progress necessitates the greatest care to prevent injury to property and persons. While holes are being loaded all dynamite and caps should be kept well off the side of the road and when shots are ready to be fired, men with red flags should be stationed on the road to stop traffic from both directions at a safe distance from the blasts. Under such conditions electric firing should always be used to shorten the time traffic needs to be held up and to eliminate all possibility of a hang-fire with safety fuse.

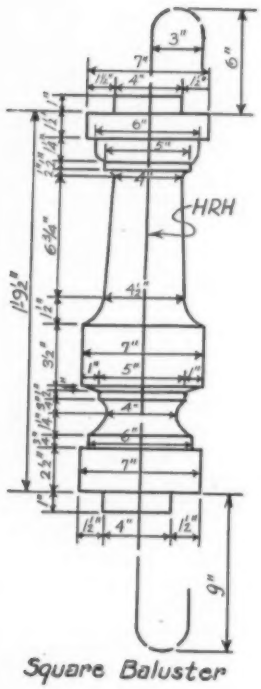
The most important measure for preventing damage to buildings and electric lines from flying fragments is to reduce the size of the shots. Each hole must, of course, be loaded heavily enough to pull its burden but holes can be drilled with lighter burdens and fewer holes can be shot at a time. In making a rock cut it may be necessary to lay logs or planks over the surface and cover these with rope blasting mats. Woven steel blasting mats are very effective for holding down the stone from a blast, but these are so heavy that they are practical only when there is a crane on the work to handle them. If steel mats are used, care should be taken to keep them from touching bare connections in the electric blasting circuit as such contact would be likely to cause a short circuit and misfire. When stumps are blasted along the right of way, the charge should be kept down to such an amount that it will not throw the stump into the air but simply split it and turn the pieces back around the hole so that they can be easily removed. When secondary blasting is necessary ahead of the shovel, block-holing is a better method than mud-capping because it does not hurl fragments so far. Even when all precautions are observed to avoid damage to electric wires from the blasting, it is well to arrange to have a lineman at hand to make quick repairs in case any damage does occur.

Blasting operations on highway construction projects are not ordinarily either dangerous or difficult but it is vitally important to the economical completion of any such project that the blasting should be efficiently managed and it should therefore be given the thought and consideration that it deserves.

RESULTS OF THE BLAST OF FOUR WELL DRILL HOLES

These four holes were drilled 49 feet deep, spaced 16 feet back from the face and 12 feet apart and loaded with a total of 1,275 pounds of 60 per cent Du Pont quarry gelatine in 4 x 16 cartridges. Very little, if any, secondary blasting was necessary

Wood Forms *for* Square Balusters—



Square Baluster

Details of the Final Work on a Concrete Bridge That Cut Costs and Another Side to the Old Question of Hand vs. Machine Work

FOR about two years the Hardaway Contracting Co., Columbus, Ga., has been working on the beautiful reinforced concrete arch and beam span bridge over the Broad River on South Carolina State Route 2, and in May completed the work except for the asphalt paving. The bridge has a total length of 1,159 feet and a width of 30 feet with two sidewalks.

Wood Forms for the Balusters

The contractor experimented with steel and wood forms for the molding of the 2,282 balusters for the hand rails on the two sides of the bridge. Steel forms were not satisfactory to use because of the constant breaking of the corners of the balusters when the forms were knocked down. The carpenters under the direction of T. A. Jamison, Vice President of the company, produced a set of forms from wood that proved very satisfactory and gave a minimum of trouble with broken corners.

The accompanying diagram of the baluster shows the design which was followed. The wood forms were made up with four sides which were set up with clamps similar to column clamps and which came off in four parts when the forms were broken down. The forms were well oiled before assembly and were vibrated by tapping while the 1:2:1 mix was being poured from the new small Smith non-tilting mixer, which was equipped with a side loading skip. A total of 150 sets of forms was made and work on the pouring of the balusters took up the odd time of the carpenter who made the forms, and who acted as foreman in assembling them, and five laborers.

Fifty forms were poured one day, the castings taken out the next day and immersed in water for 7 days and then further cured damp under cover for another 7 days. The sequence of operations for the maximum use of the forms was to pour 50 one day, clean 50 the same day and also strip 50, so that entire set of forms were in constant use during the period of manufacture of the balusters. The balusters were reinforced with a single ½-inch square bar through the center. The aggregate used was stone chips from ¾-inch down with the average size about ¼-inch. The balusters were pointed up where necessary and hand rubbed before being cast with the hand rail.

Rubbing the Hand Rail

A very interesting comparison of the cost of hand rubbing of concrete such as handrail and upper surfaces of a bridge structure as compared with machine rubbing was made by the Hardaway Contracting Co. The same organization had just completed another similar but more elaborate bridge for the State Highway Department over the Congaree River where hand rubbing was used for the entire structure. On the Broad River Bridge machine rubbing was used to the exclusion of the hand work. The costs of the hand work were approximately $15,000 for 15,000 cubic yards of concrete placed, while the work on the second bridge was about $8,000 for a total of 7,500 cubic yards of concrete.

Why the difference? There are several reasons for the difference. On the second bridge tongue and groove

lumber with a minimum specified thickness of 1½ inches after dressing was used with the hope of obtaining, not only water tight, but better forms in general. It was cut and dressed in an A1 mill and woodshop on the job but in some cases the match was not perfect due to the carelessness of the labor at times. Tongue and grooved lumber was not used on the first job. In addition, in order to hasten the work near the end of the job an unusual number of hand finishers with the pneumatic tools were put onto the work which naturally ran up the costs. Two portable compressors were used toward the end and as many as 15 laborers with the pneumatic tools were working at one time. They were selected men, but all negro laborers, and were paid about 25 per cent more than labor for this type of work.

The resulting work was a fine job and a credit to the contractor and the engineers. It is unfortunate sometimes to have to make comparisons between hand and machine work where the conditions are not identical. But, unless the work can be carried on simultaneously and under strict control it is impossible to show a direct comparison. It is interesting to note in this case, however, that a considerable number of contractors were attracted to the work and watched it carefully and then invested in similar equipment as they felt that under usual conditions there would be a worthwhile saving either in time or in labor costs for the finishing of large surfaces.

PERSONNEL

The construction of the Broad River Bridge was carried on under the direction of B. H. Hardaway, President, and T. A. Jamison, Vice President, Hardaway Contracting Co., Columbus, Ga., with L. E. McDaniel as Superintendent. For the State Highway Department the work was under the supervision of J. W. Barnwell, Jr., Bridge Engineer. Cecil Johnson was Resident Engineer, F. E. Buck his Assistant and J. C. Albergotti, C. F. Lynn and W. G. Willard, Inspectors.

Trivial Accidents on Construction Work

FIRST aid is safety for the injured, and if a way can be found to eliminate infection from the accident record of a construction firm, much will have been accomplished in the way of safety progress.

A clerk on a construction job died from blood poisoning that began from a mere pin scratch. A bricklayer cut his finger, neglected the wound, and finally had to have his hand amputated at the wrist. A laborer got a splinter in his finger and dug it out with his jackknife. Three days later he died from infection. Another laborer carrying a section of floor form stepped on a nail in a loose board and worked the rest of the day without receiving first aid. On returning home his foot pained him so bady he called a doctor. His delay in getting the proper medical attention or first-aid treatment allowed infection to set in and resulted in the loss of two toes and thirty-six weeks lost time.

Case after case like this could be described. If an interest in accident prevention could have impressed those responsible with the need of prompt and efficient first-aid treatment for *all* injuries, no matter how slight, these and many other similar cases of infection would have been avoided.

Any well-defined safety program should specifically put it up to the foremen on the job to see that their employees receive prompt first aid. An alert foreman can readily do this by being on the outlook for amateur bandages and directing an inquiry to the employee as to whether he reported for first-aid treatment.

By constantly checking up on minor injuries the foreman soon realizes what employees in his crew have low resistance because of slow healing. This is illustrated by a typical accident report from a foreman who was on the job.

"Nature of injury—slivver in hand. Happens frequently with this man. He gets a slivver in his hand and later it starts to swell. He is very susceptible to infection. A good man and we send him to a doctor just as soon as we notice any trouble. He did not want to go in this case but we insisted."

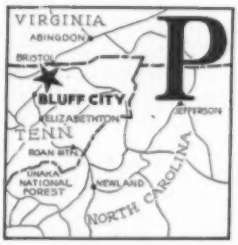
Thus it may be seen that the foreman plays an important part in preventing accidents, and also in preventing trivial injuries from becoming serious.

—From the Construction Section News Letter, National Safety Council.

CONCRETE BALUSTERS FOR THE BROAD RIVER BRIDGE NEAR COLUMBIA, S. C.

1. L. E. McDaniel, Superintendent of the Hardaway Contracting Co., holding one of the individual balusters. 2. The equipment yard after the job was completed. Note the care with which every piece of equipment was inspected, painted, greased and oiled ready for shipment to the next job. 3. The balusters in place with the rail and base

Management and Organization



PAVING contractors in Tennessee are in somewhat the same position as the grading contractors in Virginia. In Tennessee the paving contractor is presented with a grade finished to the level of the completed slab, and is asked to bid on the fine grading and laying of the slab only. In Virginia the grading contractor is asked to bid on a completed grade with a base course for a bituminous macadam surface which the State will put down. Thus, the contractors are given an opportunity to specialize in a definite type of work, making for better and more uniform work with a somewhat smaller investment in equipment on the part of the contractor, which reflected a bit too much in the bids, which have been unusually low in these states during the last eight months.

J. L. Humbard Construction Co. Uses Local Labor, Subs All Hauling and Keeps Job on Its Toes

Paving from Bristol to Bluff City

The contract for Project 224-B, in Sullivan County, a distance of 7.712 miles on State Highway 34 from Bristol, Va.-Tenn., to Bluff City, Tenn., was awarded to Jno. L. Humbard Construction Co., Knoxville, Tenn., for $143,824.28. The work consisted of laying a plain concrete slab 18 feet wide with an 8-6-8-inch cross section, the bottom of the slab being on a parabolic curve and the top having a crown of 1 inch. The slab has a center joint throughout the length of the job with 4-foot dowels, ¼-inch in diameter across the center joint every 5 feet. Headers are inserted every 500 feet, removed and poured later with asphalt by the State maintenance forces in lieu of premoulded expansion joints.

Fine Grading

Work on the fine grading was started on May 15, 1930, with 120 working days allowed for the completion of the slab and shoulders. The rough grade was completed in 1929 under another contract. The method of operation in Tennessee outlined above frees the paving contractor of any responsibility for the rough grade which is left at the elevation of the finished slab. If the resident engineer in checking the work can improve on the profile of the road by the use of different vertical curves, this may change the profile so that the paving contractor may be required to handle some excavation below the level of the forms. In this case the contract

Dressing Up the Grade with a Monarch-75 and a Ryan Grader

of a Concrete Slab Job *in* Tennessee

A Buffalo-Springfield 3-Ton Gas Roller Compacting the Fine Grade Immediately Ahead of the Paver

calls for an item "excavation" for just such contingencies.

On this contract the rough grade was turned over and to the side with a Ryan grader hauled by a Monarch 75. This earth was later used for curing the slab, and after blading off the concrete, was shaped and under a subcontract used to make the shoulders for the completed pavement.

After the Ryan grader had cut the grade to approximate line a Lakewood subgrader was pulled along the forms to secure the final grade. Western rotary fresnos were used with horses to move excess dirt piled up by the grader and subgrader. A Buffalo-Springfield 5-ton gas roller was used to compact the final grade where additional material was placed in low spots.

Form Setting

A total of 16 men was used in the fine grading and form setting. Of this outfit about 4 and a foreman were used on form setting. The 8-inch Blaw-Knox steel forms were set on an average about 1,500 feet ahead of the paver, although the state specifications call for only 500 feet.

During the first few days of the work traffic was permitted over the subgrade at a few points, but as soon as concreting started traffic was completely detoured. The right of way of the present project was about 60 per cent relocation, giving a better profile and fewer curves.

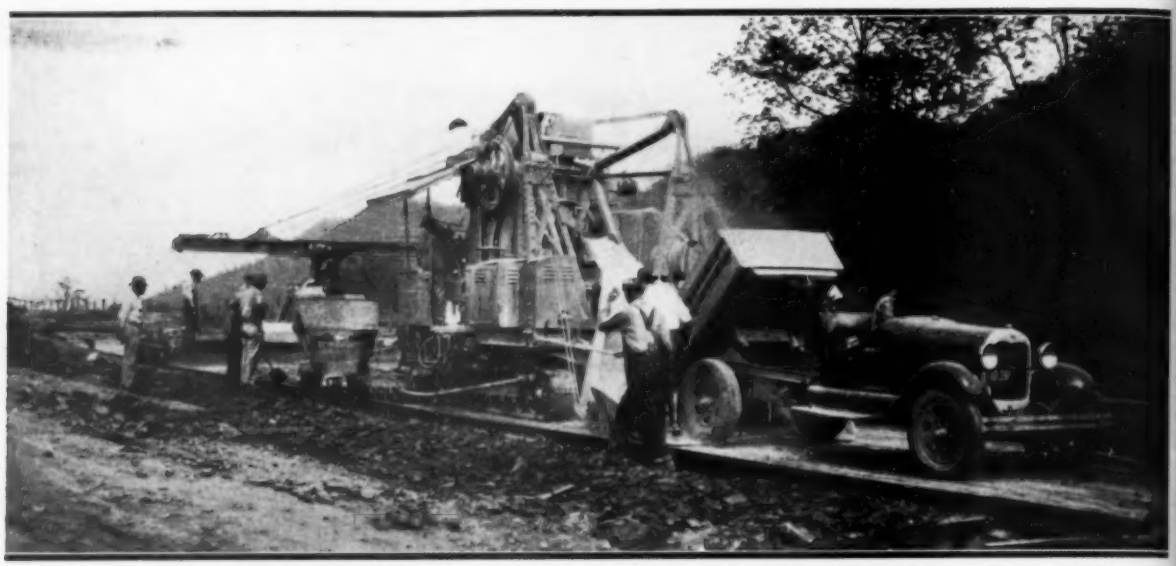
"Solid Volume Control" of the Concrete

The present contract calls for "solid volume control" of the concrete whereby the water volume is held constant, and any variation in the moisture content of the aggregates is taken care of by a change in the weight of aggregate used, the cement remaining at six bags per batch. The average batch on this project was: 1,421 pounds of sand, 2,214 pounds of stone, and 564 pounds of cement. A water-cement ratio of 0.75 was maintained. The slumps for this concrete ran from 1 to 1¼ inches, and the yield about 4.785 cubic feet of concrete per bag of cement.

Batching of Aggregates

Stone from a local quarry at Bluff City was delivered by the quarry to a stockpile at the batching plant in Bluff City about 3.5 miles average haul from the job, including a dead haul of about 0.6 mile. Sand was received from Knoxville and other eastern Tennessee points by freight, and unloaded to the stockpile or direct to the Blaw-Knox batching plant by a Koehring crane with a 1-yard Blaw-Knox Dreadnaught clamshell. The crew at the batcher consisted of three men; the crane operator, one man in the cars trimming and the batcher operator.

All hauling of batches was done by subcontract, a fleet of 19 Ford and Chevrolet one-batch trucks with balloon tires, doing the work and being paid on a square yard of completed pavement basis, the same as the contractor is paid by the State. The trucks turned through breaks in the forms and backed to the paver. The cement was loaded onto the batches by 2 men at the batching plant direct from freight cars, and the bags emptied on the batches just before dumping.



One of the Fleet of 19 Ford and Chevrolet Trucks Dumping Its Batch at the Koehring Paver

CONCRETING ORGANIZATION

The contractor has very nicely dispensed with one man in the usual concreting organization, namely, the second center steel man. The 1¼-minute mix on this job gave the center steel man plenty of time to work. Most organizations have 2 men for this work, but the Humbard outfit used one man for this work with the handy man tossing the pins and dowels into place for the setter to place. This handy man sprinkled the subgrade and cleaned up behind the subgrade planer attached to the Koehring 27-E paver. Truscon center joint was used, staked every 2½ feet and with the dowels described at the opening of this article.

The subgrade planer attached to the paver carried a tool kit and stakes for the center steel, while the center strips were carried in a rack under the operator's platform on the paver.

One man spotted and dumped the one-batch trucks as they backed to the paver, and also kept the skip clean where any cement or damp sand stuck. Two men were used to dump the cement from the bags. The paver operator spread the batches on one side of the center strip, and then as the concrete was close to the strip placed one batch along the strip to support it. This left space for the men to work on one side of the subgrade while the 2 men spreading and the 2 spaders were working on the far side. The 2 men used for shovelling also threw concrete against the front screed of the Ord machine finisher as needed. In fact, they spent more time at this work than actually shovelling, because of the care of the paver operator in spreading the batches. One man was allotted the oiling of the forms.

HAND FINISHING

Immediately following the Ord finisher two hand finishers checked the surface with a Lakewood 10-foot straight-edge and corrected any inequalities in the surface with additional concrete and hand floats. These men also hand finished the edges against the forms and the edges of the expansion joint every 500 feet. Two other men used the 10-foot longitudinal float from a double bridge 12 feet between bridges connected and mounted on wheels running on the forms. The final surface was secured by belting by the hand finishers using a canvas belt stretched taut by an arched board and operated by two pairs of plow handles.

CURING

A crew of 8 men were used to handle all the curing operations. First, after the surface had been finally checked and belted, burlap in strips was spread over the concrete from a movable bridge running on the forms. This was removed the next morning and the slab covered with earth to a depth of about 6 inches and kept sprinkled for 10 days.

Water for the paver and for curing was supplied by a Worthington centrifugal pump operated by a Novo engine. A C H & E No. 11 triplex pump was maintained as a standby at the only source of water, a rather turbid stream near the center of the work. The water was carried along the shoulder in 2-inch pipe with taps at 250-foot intervals.

QUANTITIES AND PRICES

Necessary earth excavation below the grade of the forms was done at 50 cents per cubic yard, and rock excavation at $1.50. The plain concrete for the slab was bid at $1.72 for 81,107 square yards, and the 336 square yards of reinforced concrete to connect at the bridges was let at $2.89. The figure for the completion of the shoulders was $350.00 for the 7.712 linear miles of shoulder on both sides of the slab. This is a standard figure in most contracts and is usually sublet to outfits who specialize in this work.

PERSONNEL

L. H. Kidd was Superintendent for the J. L. Humbard Construction Co., of Knoxville, Tenn. The work was carried on under the direction of R. J. Love, Division Engineer, Tennessee State Department of Highways and Public Works, with Hobart Greene as Resident Engineer.

A Section of
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News of Consultants
in the
Civil Engineering Field

The Consulting Engineer

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Mt. Hope Bridge Awarded Prize By American Institute of Steel Construction

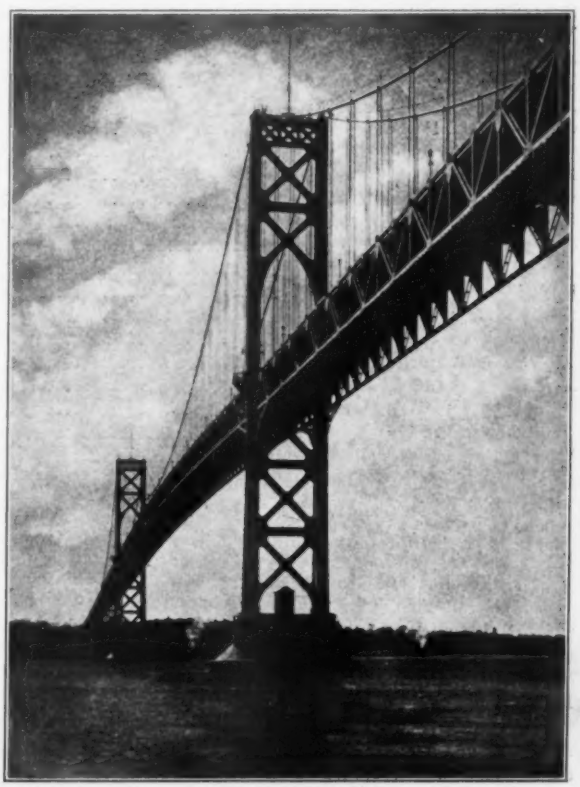
Office of Robinson & Steinman

THE Mt. Hope Bridge, designed by ROBINSON & STEINMAN, Engineers, 117 Liberty Street, New York City, has been selected to receive the annual award of the American Institute of Steel Construction as the most beautiful long span steel bridge built last year. The bridge, which extends across Mt. Hope Bay between Bristol and Portsmouth, R. I., was erected by McClintic-Marshall Co., Pittsburgh, Pa.

This bridge, the construction of which was described in an article in the December, 1928, issue of CONTRACTORS AND ENGINEERS MONTHLY, was built at a cost of $4,250,000 to provide the shortest direct highway connection between Providence and Newport and is the largest bridge in New England. The total length of the bridge is 6,130 feet; the main span is 1,200 feet long and 137 feet in clear height above the water and the main towers are 325 feet high. The structure is of the wire cable suspension type, with steel viaduct approaches on concrete piers. The main piers and the massive anchorage are faced with granite and all the concrete work is finished with architectural paneling. Special attention was given to the artistic design of the bridge and its approaches and landscape and gardening treatment have been given to the property at both ends of the bridge. T. E. Blake collaborated on the architectural features including the approaches and toll house.

The construction of the bridge was commenced at the beginning of 1928 and the entire construction was completed in 22 months. The foundation men and steel erectors worked night and day in order to keep up the pace they had set themselves. The field organization employed on this work amounted to nearly 300 men. Fifty per cent of the work, including the foundation operations, was completed in less than one-third the contract time. The progress of construction was beyond anything previously recorded on a bridge of this size. First the approaches and viaduct piers were built, and then the viaduct spans erected. After the foundations and main piers in the channel of Mt. Hope Bay were completed, the high main towers were erected. The masonry anchorages on the Bristol and Portsmouth shores were then built to the level required for the stringing of the cables. Following the spinning of the thousands of miles of wire back and forth over the tops of the main towers to form two powerful cables, the main spans were hung from these cables to complete

(Continued on page 87)



The Mount Hope Bridge from Bristol to Portsmouth, R. I.

The Consulting Engineer

A Section of

Contractors and Engineers Monthly

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J. Paul Blundon, Law Building, Keyser, West Va., is at present engaged in the preparation of plans for water filtration plants for Piedmont and Richmond and an intercepting sewer for Keyser, all in West Virginia. Mr. Blundon recently was called as expert witness in the following cases: United Fuel Gas and Warfield Natural Gas rate case; Monongahela West Penn Public Service Co. gas rate case; Beckley Water Co. rate case, all of which are pending before the Public Service Commission of West Virginia.

Engineer Reports on Proposed California Highway

AN exhaustive report was made recently by WALTER WILSON CROSBY, Consulting Engineer, 1118 Orange Ave., Coronado, Calif., in the matter of the proposed cliffside highway to eliminate the Torrey Pines grade on the main state highway entrance to San Diego from the north and west, just south of Delmar. Mr. Crosby, who was retained as Consulting Engineer for the Board of Park Commissioners of San Diego, concluded that the proper solution would be the ultimate construction of a highway on the east rather than the west side of Del Mar Hill.

In summarizing the report, it is pointed out that the proper solution of the Torrey Pines grade problem demands a recognition of the larger question, that of the location of the coast highway, U. S. Route No. 101, between Six Points and Del Mar. That solution calls for a location from the top of the grade south of Del Mar down into Soledad Valley, and thence up again to the present highway on the mesa at a point as far as practicable north of Six Points and almost wholly avoiding Torrey Pines Park. Such a solution is entirely practicable at not excessive cost, and when made is likely to remain satisfactory as a solution for some time to come.

W. W. Crosby

The proposed "Cliffside Road" eliminating Torrey Pines grade, is feasible but excessively costly in construction if not in maintenance. It would do a maximum of damage to the park and offers no compensatory advantages such as developing the park for more general use. If a main through-highway has to be built through the park, less damage to the park, less expense for construction and maintenance, and a shorter line may be provided by a route to the east of Torrey Pines lodge. Such a location would be nothing but a through road, and would in no way develop park use.

The present roadway from the mesa through the center of the park to the causeway can be materially improved at a relatively low cost, and if so improved would prove quite satisfactory, for a reasonable time, as a main highway pending the construction of Del Mar-Soledad Valley-Six Point line suggested as the solution of the major problem. Ultimately a park road along the cliffs will probably be desirable, but then it should be carefully planned to make the most of the opportunities as such and with as little damage to the terrain or offense to the park as possible.

Other activities of Mr. Crosby include the preparation of plans for boats and shore works for the Automobile Ferry Co. of Coronado, Calif., a new ferry to operate between Coronado and San Diego. Mr. Crosby also recently contributed some discussion on the paper of Donald Baker, C. E., of Los Angeles, on "Airport Location" before the Amer. Soc. C. E., which discussion will be published in an early issue of the *Proceedings*, Amer. Soc. C. E.

Consulting Briefs

George B. Gascoigne, 1140 Leader Building, Cleveland, Ohio, is at present preparing a comprehensive plan of sewage, drainage and water distribution for the Town of Tonawanda, N. Y., and a comprehensive plan of sewerage for the City of Buffalo, N. Y. A storm drain at Ellwood City, Pa., and the sewage treatment works at Chattanooga, Tenn., are being constructed under Mr. Gascoigne's supervision.

Weston & Sampson, 14 Beacon St., Boston, Mass., has been making investigations for a valuation case for the Cities of Paterson, Passaic and Clifton, N. J., and the Connecticut River and Delaware River cases as well as carrying on a large amount of laboratory work, including the preparation of a report on forty-eight railroad water supplies for the International Railways of Central America.

Waddell & Hardesty, 150 Broadway, New York City, are at present engaged in the preparation of plans for the Putts Bridge, Springfield, Mass.; Tuckerton and Little Beach Bridges, N. J., the Brunswick Pike Bridge, N. J.; the Hudson River Bridge at Albany, N. Y.; and two bridges over the Niagara River from Grand Island to the mainland. The construction of the Maumee River Bridge, Toledo, Ohio, is being carried on under this firm's supervision.

Charles Foster, Consulting Engineer, 512 Sellwood Building, Duluth, Minn., is preparing a report and recommendations for the municipal plant at Brookings, S. D., and plans for the mechanical equipment for the Municipal Air Hangar, Duluth, and for the new County Work Farm buildings, Duluth.

Lamar Acker, Nacogdoches, Texas, has recently prepared plans for the complete systems of driveways for the local state college. He also recently supervised paving for San Augustine, Texas.

H. A. Marshall, Room 6, Smith Building, Topeka, Kans., is preparing plans for nine bridges in Miami County, ranging in length from 40 to 80 feet, with the exception of one across Marias des Cygnes River, which will be approximately 300 feet long. The county road system for Miami County, Kans., consisting of grading, culverts and a sand surfacing is being constructed according to plans prepared by Mr. Marshall.

Alvord, Burdick & Howson, Engineers, have announced the removal of their offices to Suite 1401-06, 20 North Wacker Drive, Chicago, Ill. This firm specializes in the preparation of investigations, reports, designs, estimates, plans and specifications for the construction and improvement of engineering works, such as water works and water purification plants, flood relief projects, sewerage and sewage disposal works, appraisals, rate reports and power generation projects.

Thomas B. Stockham, Reg. Engineer, 8 Stockham Bldg., Morrisville, Penna., reports that he is designing a home economics cottage for the Morrisville Public Schools and a cleaning and dyeing factory for the Moses French Cleaning & Dyeing Co., Morrisville. He is also supervising the construction of an 8-room school being completed at Fallsington, Penna., and a 12-room school and gymnasium being started at Morrisville.

Moran & Proctor, 342 Madison Avenue, New York City, are preparing plans for the foundations of the Walker-Lispenard Telephone Building, to be erected at Walker and Lispenard Streets, New York, and are supervising the construction of the foundations for the City Bank Farmers Trust Building, also in New York.

Kastenhuber & Anderson, Civil Engineers and Surveyors, Easton, Md., are preparing plans for curbs and gutters and also improvements in sewage disposal plants for the town of Easton. The construction of sewer extensions in Easton and the Ferry Terminal, Kent Island, Md., is being carried on under their supervision. W. H. Morris, Resident Engineer, Kent Island Terminal, recently joined the staff.

C. M. Ayres, Tuscaloosa, Ala., is preparing plans for an 800-ton coal storage bin for the Seaboard Coal Mining Corp. The bin will have a concrete foundation and wooden frame.

G. J. Wagner & Co., 303 Home State Bank Bldg., Grand Rapids, Mich., is working on reports for the determination of sewer and water rates for the village of Wayne, Mich., and for the determination of the value of the water power rights of the Consumers Power Co., in Michigan. Mr. Wagner has also recently been called to give expert testimony in the case of the Michigan Public Utilities Commission vs. the Michigan Bell Telephone Co., which is in the Federal Court in Detroit.

Lafayette Higgins & Son, 211 Continental Bldg., Des Moines, Iowa, has prepared plans for a sewage filter at Newton, Iowa, the contract for which was let March 24, and are also supervising the construction of a sewage treatment plant for the Independence State Hospital, Independence, Iowa.

C. N. Harrub Engineering Co., 705-9 Fourth and First National Bank Bldg., Nashville, Tenn., is preparing plans for paving in Aberdeen, Miss., sewers in Lewisburg, Tenn., paving in Houston, Miss., and water supply for Columbia, Ky. Construction now going on under this firm's supervision includes a waterworks plant and power plant, Murfreesboro, Tenn., a sewerage system, Houston, Miss., and a paving job in Dawson Springs, Ky.

The Pace Co., 14 East Jackson Blvd., Chicago, Ill., is preparing a general industrial survey for the Illinois Central Railroad and a terminal and industrial survey for Portland, Ore. David O. Taylor, Consulting Geologist, has recently joined the Pace staff.

Brown & Myers, 1721-23 Petroleum Bldg., Oklahoma City, Okla., is now engaged in structural and mechanical work on the following schools in Oklahoma City: additions to the Capitol Hill High School, University Heights Grade School, Heronville, Shields Heights, Lee, Harmony, Gatewood, Bath, Hawthorne, Cleveland, Dunbar and Westwood Schools; the high school at Maud, and the Grisso Hotel at Seminole, Okla.

Plans to Solve Sewage Problem

Henry W. Taylor

ANNOUNCEMENT has been made of the recent appointment of HENRY W. TAYLOR, 11 Park Place, New York City, as Consulting Engineer on the sewerage development for the City of Rome, N. Y., for which $300,000 has been appropriated. This action of the city takes up the solution of a sewage disposal problem which has been in existence for the last twenty years and has given rise to the payment of large damages to property owners along Wood Creek, which is at present the point of disposal of the raw sewage.

The project under consideration includes the installation of new intercepting sewers with pumping stations to divert the flow of sewage to the east of the city with ultimate disposal in the Mohawk River. The disposal plant will include preliminary treatment only. Plans are now being prepared for the work and will be submitted to the bidders at the earliest possible moment. These plans represent a complete change in scheme as compared with those previously considered and involve a saving to the city of about $500,000.

Engineer Opens Richmond Office

TO better serve Virginia clients, GILBERT C. WHITE Co., Durham, N. C., opened an office in the Richmond Trust Building, Richmond, Va., on June 1, with Preson P. Phillips in charge. Mr. Phillips is a graduate of the Virginia Polytechnic Institute, and has had fifteen years' experience in the design and various classes of municipal construction.

Gilbert C. White Co. recently completed a report on an outfall sewer 6 miles long from Hazelwood, through Waynesville and around Lake Junaluska, N. C., with 15, 18, 21 and 24-inch pipe to be used. The construction of the curb and gutter, street paving, water and sewer extensions for the town of Sanford, N. C., and the waterworks for Concord, N. C., have recently been completed under supervision of this company.

Californian Publishes Economic Analysis

A RECENT publication, "Stock Speculation and Business," has been written and brought out by GEORGE L. HOXIE, 306 West Third Street, Los Angeles, Calif. This book, in the words of the author, is "rawhide economics," dealing with a rigidly accurate economic analysis in the simple language of the layman. The mechanics of the stock market is outlined, yet the main theme of the book is the close connection between stock-trading and general business. The book is published by the Stratford Co., Boston, Mass.

Mr. Hoxie is at present engaged in the preparation of economic studies for the condemnation cases brought by the City of Los Angeles before the California Railroad Commission for the attempt to take certain distribution properties of the Southern California Edison Co., Ltd., in that city.

Municipal Projects of Texas Engineers

PLANS are being prepared by MONTGOMERY & WARD, Consulting Engineers, Wichita Falls, Texas, for a water works system for Toyah, Texas, and also for a 19½-mile supply main from Toyah to Pecos, for the City of Pecos. Both Toyah and Pecos will have their water delivered to them by the T & P Railway Co. at Toyah. Other projects for which plans are being prepared are street paving and a park for Hereford, an appraisal of a light and ice plant and for street paving, Spearman, and plans for a park, Plainview, Texas.

Activities of Fay, Spofford & Thorndike

PLANS and specifications are now being prepared by Fay, Spofford & Thorndike, 44 School Street, Boston, Mass., for the construction of an earth dam and reservoir to provide additional water supply for the City of Gloucester, Mass. The work will include an earth dam with concrete core, gate house, spillway and appurtenant structures, an elevated storage tank and the preparation of the reservoir site, at a total estimated cost of $350,000.

The April issue of the Journal of the Boston Society of Civil Engineers contained a paper, "Fire Protection Engineering as Applied to Municipalities," by Kenneth F. Akers, Fire Prevention Engineer of Fay, Spofford & Thorndike. The paper was presented before the Society in January.

Chicago Engineer Incorporates

ANNOUNCEMENT was made recently of the incorporation of the engineering service of L. F. Harza, Consulting Engineer, under the name of Harza Engineering Co., with offices at 20 North Wacker Drive, Chicago, Ill. The officers of the new company are L. F. Harza, President, Member, Amer. Soc. C. E., A. I. E. E., A. S. M. E., West. S. E.; Erik Floor, Vice President, Member, West. S. E., and James S. Bowman, Secretary, Member, Amer. Soc. C. E., and A. S. M. E.

This company is at present engaged in a number of hydro-electric projects in Northern Ontario, Canada, Michigan and some preliminary work on projects in Kentucky, Oklahoma and Wisconsin.

(Photo of Mr. Harza by Blank & Stoller)

OFFICERS OF THE HARZA ENGINEERING CO.
Left to right: Erik Floor, Vice President; L. F. Harza, President; James S. Bowman, Secretary

Mt. Hope Bridge Awarded Prize

(Continued from page 85)

the structure.

The wire of the cables is approximately the thickness of a lead pencil and each cable consists of 2,450 of these wires, laid parallel, to make up the circular section of 11 inches in diameter. The two cables alone weigh 700 tons, containing 14,000,000 feet of wire, or a length of nearly 3,000 miles.

D. B. Steinman

The anchorage at each shore is a mass of concrete and granite encasing the anchorage steelwork. The Bristol anchorage weighs 18,000 tons and is entirely below ground. The Portsmouth anchorage is even larger, weighing 27,000 tons.

The American Institute of Steel Construction made two first prize awards, the first going to the most artistic long-span bridge and the other to the most artistic short-span bridge. The Mt. Pleasant Bridge, constructed by the Bethlehem Steel Co., over the Harlem Division of the New York Central Railroad at Mt. Pleasant, N. Y., for the Westchester County Park Commission, was judged to be the most beautiful short-span bridge.

Honorable mention as a most aesthetic solution of a long-span bridge problem was given the Lake Champlain Bridge, built by the American Bridge Co., across Lake Champlain between Crown Point, N. Y., and Addison, Vt. Fay, Spofford & Thorndike, Engineers, of Boston, designed the structure, which was described in CONTRACTORS AND ENGINEERS MONTHLY, August, 1929.

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The Editor Comments —

A Contractor's Contribution Toward Solving the Unemployment Problem

The unemployment problem has been acute in all parts of the country since the stock market crash of last fall. The President called upon every industry to contribute its strength to solve the problem of thousands of men out of work. States, counties, municipalities and industries responded and the peak of unemployment was reached in March when the newer work was organized and many of the unfortunates were aided by the projects started at that time.

During my southern trip in May and June a notable example of what at least one contractor has done to help out in this crisis came forcibly to my attention. About fifty years ago the firm of Fuccy Brothers was organized in West Virginia. That notable contracting organization was responsible for a large portion of the railroad construction in that mountainous state. Their construction camps were scattered every ten miles or so throughout the state during the height of the railroad construction era. When the full quota of railroads was completed the Fuccy Brothers turned their attention to the building of highways. The original brothers died, leaving the business to the three Fuccys who now are as well known in the state highway construction field as the original brothers were known in railroad construction.

I visited their work south of Weston, their home town, and saw much of interest which will be described in a later issue of CONTRACTORS AND ENGINEERS MONTHLY. But, the fact that impressed me most was the apparent over-organization as far as the number of men engaged in hand work on the fine grade was concerned. Where a labor gang of 35 men might be considered adequate, Fuccy Brothers were using nearly four times as many. At lunch at the home of the post mistress of the little town where the batching plant was located I had a long talk with the third of the brothers I had met on the job. I put the question to him squarely, "Why are you using so many more men than are really necessary on the fine grade?"

With the pleasant smile which is characteristic of the three brothers he explained the very good and Christian reason why so many extra men were employed. Fuccy Brothers had responded to the appeal of the President of the United States for industry of every kind to assist at least until May in giving employment to every man possible. Fuccy Brothers were engaged in a road building job in their own county near their own home town, they put every able bodied man they could possibly carry onto the work and they helped in great measure to overcome conditions that approached starvation rations for many of the families.

There have undoubtedly been other contractors that have contributed as much, perhaps more, to the welfare of the country during this crisis but they have not come to our attention as forcibly as did Fuccy Brothers. Our hat is off to Fuccy Brothers and the fine group of men they represent who have been willing to forget profits for this year, who have said good-bye to the profits of yesteryear and have given their all to their fellow men who have through no fault of their own been forced almost to the point of seeking charity for their families during the period of financial distress.

Industrialists Spoiling Own Game

After the fireworks were all shot off on the Fourth I had a long talk with the New York manager of a large construction equipment manufacturer. He has been up against an unusual condition in the industrial field that shows a wrong idea in handling the business conditions of today. The presidents and executives of these industiral organizations are talking optimism and spending, while their purchasing departments are telling the salesmen that they are not buying a thing that is not absolutely necessary at this time. They are running on the last tag end of their equipment without replacements. What is the result? The men in the department, the salesmen and all that come in contact with them carry the idea home and even though they are receiving the same income they had last year and consequently are as able to spend today as they were last year, they postpone their expenditures for home and self and the feeling becomes general that money is tight.

Who is responsible? The executives who have issued the optimistic statements and at the same time are using their own organizations as centers for the dissemination of "hold onto your money" tactics. Spend where necessary and don't be a tightwad! The country needs fair and conservative spenders today more than ever before. Don't throw away your money but spend it for what you need, and do it now.

Interesting Articles to Come

A heavy grading contract in the heart of the famous Blue Ridge range will be described in the article "Blue Ridge Mountains of Virginia Scene of Heavy Grading Contract" in the August issue of CONTRACTORS AND ENGINEERS MONTHLY. This job is particularly interesting because of the many and unusual difficulties encountered and the successful manner in which the contractor handled them. Another interesting job to be described in "Novel Use of Pavers" to appear in an early issue is that of a grade crossing elimination on which the concrete was poured by a paver which was moved about under its own power as needed.

Theodore Reed Kendall

A Close Up of the Two Dewatering Pumps. The One in the Foreground Is Pumping Out the Hole While the Other Is Used for Sluicing Earth and Loose Rock Off the Canyon Walls

A Dam Site Unwatered by Suspended Pumps

PUMPS suspended from cables stretched across a canyon were used by the General Construction Co. of Seattle, Wash., to remove water from the site of the dam now being constructed at Owyhee, Oregon. The construction of the Owyhee Dam is a $17,000,000 project undertaken by the United States Government in the extreme eastern part of Oregon near the border of Idaho in Malheur County. The project involves the building of a concrete dam across the Malheur River to a height of approximately 25 feet and having a length at the crest of about 1,500 feet. This will back up the river for 52 miles. The stored water is to be used to irrigate a large fertile area extending from Nyssa to Ontario and Vale, covering some 120,000 acres.

The diversion of the river necessitated the construction of a tunnel 25 feet in diameter and 3,000 feet long through solid rock. With this completed and the river diverted from its old channel, it was necessary to remove the water remaining at the dam site in order to begin construction of the dam foundations.

Two electrically-operated pumps were furnished for this purpose by the Byron Jackson Co., each a No. 3-A Deepwell unit with 6' feet of column and direct connected to a 75-horsepower General Electric induction motor. These pumps were suspended on cables, which were stretched across the canyon, and the pumps were raised and lowered by means of a winch located on the platform where the pump was mounted. Magnetic control was used to start and stop the pumps, push button stations being placed on the platform where the pump attendant was located. This made it unnecessary to mount heavy starting equipment on the platform, which had to be raised and lowered to meet the water conditions.

The two pumps together handled almost 5,000 gallons per minute, as one pump discharged through a 500-foot line of 10-inch pipe, the friction from this and from a gate valve in the line brought the total head on the pump close to 120 feet. As a result the 75-horsepower pump motor was constantly overloaded, handling a load of about 90 horsepower. The conditions were better at the other pump, whose motor had but a 45-horsepower load. The overload on the first pump was taken care of by the installation of a medium-capacity impeller.

Highway Construction Shows Marked Increase

STRIKING activity in highway construction this year is indicated by reports from thirty-five states. Thirty of these states report increases, while sixteen have announced that contract awards for the first quarter of 1930 are 100 per cent or more over the same period of last year. The figures which cover almost 75 per cent of the country, show contracts awarded during the first quarter of this year valued at $114,-101,383, against $50,910,133 for the corresponding period of last year, a net increase of slightly over 124 per cent of the group of states which have reported thus far.

The great increase in early season highway construction is a matter of considerable national importance. Improved highways represent a material contribution to the stabilization of business conditions of the present and the future, and the large volume of early awards may be especially significant in connection with the problem of spreading employment throughout the year. In addition to facilitating the distribution of the innumerable products of the farms and factories when completed, highway construction operations under way involve the use of millions of tons of material drawn from widely separated sources, and they provide employment both directly and indirectly over broader areas than any other type of public work. It is estimated that nearly 50 cents of each dollar spent for highway building and maintenance is paid for the labor involved.

Shipment of Four 56-S Ransome Standard Building Mixers to the Arundel Corp., Baltimore, Md., Contractors for the Pennsylvania Water Power Co.'s Dam Across the Susquehanna River at Safe Harbor, Pa.

How the Other Fellow Did It

Construction Briefs

Sad Error Quickly Corrected by Welding

31. On a recent highway bridge job all of the preliminary work had been completed and steel construction was about to begin when it was discovered that the anchor bolts in the foundation were not long enough. These 5-foot bolts had been sunk in the seven concrete footings of the bridge, four bolts to each footing. To tear out the concrete piers and pour new ones with longer bolts would be a very expensive procedure. To core out around the bolts deep enough to sink new ones properly would be nearly as costly and still unsatisfactory. It was decided to cut off the threaded bolt ends and weld on new lengths that would give the desired extension.

An oxy-acetylene cutting blowpipe was used to remove the threaded portion of each bolt. Then the remaining portion of each bolt was beveled with the cutting blowpipe to 45 degrees and the same was done on the unthreaded end of each extension piece. The final step was to weld the extension to the stump. In doing this a reinforcement of ⅛-inch was built up around the joint. This insured an entirely satisfactory strength and did not interfere with the function of the bolts since the hole in the column base was somewhat oversize. One welder and a helper did the entire job in three days and then the bridge construction went ahead on schedule. 18.2.106

Operating a Paver on a Steep Hill

32. There are many cities like Pittsburgh, Seattle and San Francisco where there are side hill streets which are very steep. In one case where one of these steep streets was being paved with concrete the contractor pulled in his crawler paver and found it necessary to use motor trucks to tow the paver up the slope and to ease it going down. At other times it was necessary to place the mixer at the top of the grade and run the concrete into place by wooden chutes, but the best bet was on a street with a grade of 22 per cent where the paver was run up to the point where it was going to be used and then out onto a heavy triangular piece of timber which kept the machine level during mixing. 18.2.106

Loading Direct to Motor Trucks

33. When filling a large order for pit-run sand and gravel, a Muncie. Ind.. operator made an interesting use of his slackline cableway by moving the stop button down the track cable so that the bucket would discharge directly into trucks spotted below. Most of the trucks had a capacity of 1½ yards and since the cableway was of ¾-yard size, each truck was loaded in two trips of the cableway bucket and about 350 cubic yards of material were handled per day. Ordinarily, the cableway delivers material direct to the small screening plant.

Handling Sand with an Elevating Grader

34. Even sand, always a hard proposition for earth handling contractors, has now been handled with an elevating grader. In cutting a street through a sand dune and filling in another stretch about half a mile away, a contractor on an Indiana subdivision used an elevating grader with a power take-off delivering to 7-yard crawler dump wagon hauled by crawler tractors. Had it not been for the power take-off feature of the elevating grader it would have been impossible to have used it in the shifty sand because the elevators on other graders driven through the rear wheels failed to function because they could not get sufficient traction. 17.3.144

Portable Loader Proves Handy in Building Sewer

35. The value of a portable loader in sewer construction was well illustrated on a Philadelphia sewer contract where a sewer 12 feet 3 inches in diameter and 4,000 feet long and from 30 to 40 feet below ground level was under construction. The construction work was carried in both directions from a central shaft and in each heading a 21-foot portable conveyor was used. Each conveyor was mounted by the contractor on a small four-wheel industrial truck running on a 30-inch gage track. The discharge height of the conveyor was 4 feet 8 inches above track level.

Men shoveled the dirt into the low foot end of the conveyor which was of the belt type and carried the dirt along its 21-foot inclined length up to the discharge point where it delivered into a side dump car. The cars were pulled along by storage battery trucks to the elevator shaft where the excavated materials were raised to the surface for disposal. The conveyor was pushed along the track as needed.

Before the conveyors were installed about 5 feet of tunnel was excavated per day, but with the aid of the loaders and careful planning of other details, the work was speeded up so that from 60 to 70 feet per week was the regular advance, giving a little better than 10 feet per day. 18.1.50

From Scrap Iron to Carpenter Horses

36. With the increasing use of oxy-acetylene welding by contractors more and more ingenious methods are being devised for the use of scrap metal. Practically any contractor needs a pair or two of carpenter horses and there are very few contractors who are without these handy accessories. The trouble with most carpenter horses lies in the fact that they are usually made of wood and have a tendency to break or spread after they have been subject to any hard usage.

A welder in the shop of an Eastern contractor, realizing this, constructed a pair out of scrap iron. The finished product was an agreeable surprise to the carpenter's gang and a great improvement over the wooden ones that had been used in the past. It was a simple task to weld these pieces of scrap together. The pieces were all run with butt type joints and a small amount of welded rod added for extra strength. 18.3.194

Portable Lighting Plant Made Night Subgrade Work Possible

37. A feature of an Ohio State Highway contract and one which speeded up the work was the method of preparing the subgrade. This work was done at night by an extra shift of men under the illumination of a powerful searchlight operated by a portable lighting plant. A force of about 20 men started work on the subgrade as soon as the mixer shut down in the evening. This enabled them to carry on the work without being interrupted by the trucks. A definite amount of work for the next day's run was laid out covering the preparation of the subgrade and setting the side forms. As soon as the task was completed the men were released. The work was generally finished between midnight and 2 A.M. No difficulties were encountered due to inaccurate work and the form setting and operation of the subgrade machine could be carried on without interruption due to hauling. This method, considered with reference to the general progress, was found to be much more economical than doing it during the day. 17.4.228

Legal Points for Contractors

These brief abstracts of court decisions in the contracting field may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt consult your own attorney

Edited by A. L. H. Street, Attorney-at-Law

Signing Unread Contracts

It is true that all important agreements should be "put in black and white." But they should also be read.

It is amazing how many people slap their "John Hancocks" on the "dotted line," without making sure what they are signing. Often they do not find out until a heavy money loss or litigation stares them in the face.

Haste in signing papers that create legal right and liabilities cannot be justified on the ground that the signer is already late for lunch, or that his wife is waiting for him in front of a movie theatre.

A recent decision of the Kansas City Court of Appeals goes so far as to hold (Zeilman vs. Central Mutual Insurance Assn., 22 S. W. 2d, 88) that a person cannot even avoid the effect of a contract on the ground that he could not read. There is considerable sense and justice in the following statement by the court:

"It is well settled that where a person cannot read it is ordinarily as much his duty to procure some person to read or explain the contract to him before he signs it as it would be to read it before he signs if he were able to so do. Failure to obtain such a reading of the contract, or explanation of it by some one upon whom he has a right to rely, constitutes such gross negligence as will estop him from avoiding it on the ground that he was ignorant of its contents."

For like reasons it seems to be quite clear that if one can read, but does not understand what he is reading, because of technical language of the contract, it is up to him to have the effect explained to him by some one who knows, before signing.

Contractors Liable for Damage Done by Concussion, as Well as by Projectiles, in Blasting

Ordinarily, one is not liable for damage caused to another unless the result of carelessness or wilfulness. But there are exceptions to the rule, and one of these exceptions applies where a contractor causes damage to nearby property through blasting.

In the case of McKenna vs. Pacific Electric Railway Co., 286 Pac. 445, decided by the California District Court of Appeal March 18, 1930, a contractor was found to be liable to a property owner in Los Angeles, on account of injury resulting from vibration and concussion produced by blasting in constructing a street railway tunnel in that city. The court said that it was no defense against liability that the work may have been done with care. It has been very generally held by the courts that where a particular act has a natural tendency to injure another, the person committing it must pay damages for resulting injury or take steps to prevent the injury.

In its opinion, the court refers to court decisions declaring contractors to be liable for damage to property due to flying material, and remarks that no sound distinction can exist, as to liability, between damage done by flying missiles and by concussion.

Delays in Enforcing Rights Are Dangerous

While the layman is "razzing" the courts about dilly-dallying in deciding cases he should be careful to avoid losses due to his own delay in bringing claims to the attention of the courts.

That a delay in suing may be much more harmful than a court's delay in deciding the case after it is brought is illustrated by the decision handed down December 3, 1929, by the West Virginia Supreme Court of Appeals in the case of Mills vs. Indemnity Insurance Co. of North America, 150 S. E. 718.

A bridge contractor sublet part of the work. The subcontractor gave a surety company bond to secure performance of the subcontract. But the bond said the surety company should not be liable on it unless any suit on the same be brought within six months after the date fixed in the contract for completion of the job. The contract did not fix any date for completion.

Sixteen months after actual completion, the general contractor sued on the bond, claiming that since there was no time fixed for completion the time limit fixed in the bond did not apply.

The court decided that, for want of specified time for finishing the job, the parties must have intended that the work be completed within a reasonable time. Giving the bond the interpretation most favorable to the contractor, the court said that the time for suing commenced to run from the date of actual completion. And one year and four months was too long to wait after that time before suing on the bond.

A Trivial Variation from Bidding Specifications Does Not Invalidate Contract

Most contracts for public construction are governed by a law or charter provision that requires an award to be made to the "lowest responsible bidder." But experience shows that occasionally a public board has a favorite to whom it is desired to let a contract at a good round price. That naturally means a temptation to invite bids for work according to certain specifications, on a secret understanding that the favorite will bid low and that the specifications will be later altered so that his contract will be a favorable one. The courts will closely scrutinize any change in specifications after bidding, on the complaint of a taxpayer or unsuccessful bidder, and if it appears that there has been no award to the lowest responsible bidder on the specifications actually adopted, the award is very apt to be upset.

But that does not mean that there cannot be a hair's-breadth variation between the advertised specifications and those actually adopted. As said by the Michigan Supreme Court in an opinion filed June 3, 1929, in the case of Pascoe vs. Barlum, 225 N. W. 506:

"Not every variation from the specifications will destroy the competitive character of the bid. To have that effect, the variation must be substantial. To be substantial, it must affect the amount of the bid. It must give the bidder an advantage or benefit not allowed to other bidders. It must be an element considered in fixing the price."

Using Postal Cards in Collecting Bills

One of the most dangerous ways of being "penny wise and pound foolish" is to use a postal card in dunning a debtor, when the same message could be sent with safety in a sealed envelope for two cents.

One may go a long way in a letter in telling a long delinquent debtor what he thinks of him. The creditor must not threaten criminal prosecution, or injury to person or character as a means of coercing payment, although he may threaten to sue on the debt and garnish the debtor's salary or bank account, in a letter.

But the federal postal laws do not permit threats of any kind to be written on the outside of an envelope or wrapper or on a postal card. Even so mild a threat as, "Suit enters unless you act promptly," written on a postal card has been held to constitute a violation of the United States Postal Laws, (237 Fed. 401). In another case, where a creditor not only threatened legal proceedings but also said that the debtor-addressee had been "fighting time all along" and that the creditor would be disinclined to sue if the debtor would "only be half white," the court held that there was a double offense—threat and defamation. (89 Fed. 971.)

In a third case, the following statement on a postal card was held not to be unlawful, but the creditor had to hire a lawyer to establish that point: "Please call and settle account, which is long past due, and for which our collector has called several times, and oblige," etc. (40 Fed. 664.)

Issuing Checks Against Insufficient Funds

It is very commonly but mistakenly supposed that the issuing of a post-dated check to pay a past-due bill necessarily makes the drawer of the check subject to punishment as for a specie of false pretenses, if the check proves to be worthless. In a few states, it may be that there are statutes so worded as to make the giving of a bad check unlawful under those circumstances. But in most of the states it is generally held that the "bad-check" statutes are not broad enough to fit such cases.

One of the latest decisions on this subject was handed down by the North Carolina Supreme Court, where a debtor was acquitted on a charge of issuing a worthless check. The court decided that by issuing a post-dated check the maker merely indicates his expectation that he will have money in the bank to cover the check on the date of the check. His failure or inability to make the check good cannot constitute criminal fraud.

Termination of Employment

Where a contractor employs a foreman, superintendent or other employee for a fixed term of considerable duration, a few apt words in the contract may serve to protect the right of termination should the employer's interests later on make it desirable to terminate the contract.

Before the contract period has expired, the contractor may desire to sell out his business and move away. But that does not terminate the employee's right to the agreed compensation for the remainder of the employment term, or to damages for breach of the contract. The same is true in case the contractor forms a partnership with some one else and finds that he has no longer need for the employee's service. Or, where a partnership is the employer, dissolution of the partnership will not relieve the partners from their obligation to either provide continued employment for the employee or respond to him in damages for the termination of his contract.

A dropping off in volume of business to the point where there is no need for the employee's services will not justify the employer in putting an end to the employment before the contract time expires, unless the right has been especially reserved in the contract between the two parties.

But, of course, it is not necessary to specially reserve the right to discharge the employee for insubordination, dishonesty, carelessness or other similar cause, because one party's breach of a contract justifies the other in terminating the agreement immediately.

When Contractor Cannot Deny Agency in an Employee

Were an ordinary laborer in the employment of a contractor to pretend to make a contract for the purchase of materials on the part of his employer, without authority, the contractor would have little or no trouble in avoiding liability on the contract. No one has a right to assume that a laborer is empowered to make contracts for his employer.

But it is not necessary that the contractor explicitly authorize an employee to make contracts for him before they may be enforced against him. In fact, the employee may have been specially instructed not to make them. In other words, where a contractor places a representative in charge of work, with an appearance of authority, third parties not knowing of any limitation on his authority have a right to assume that he possesses the powers usually conferred upon foremen or superintendents under similar circumstances.

This last stated rule was applied in an opinion handed down by the Arkansas Supreme Court, September 23, 1929, in the case of Lakeside Bridge & Steel Co. vs. Duvall, 19 W. 2d, 1107. The court decided that Duvall was justified, under the circumstances, in assuming that certain agents of the company were empowered to contract with him for the hauling of materials used by the company on a highway job.

The decision was influenced somewhat by evidence tending to show that the company knew that the contract had been made and made no objections to it. It is very generally held that ratification of an agent's unauthorized act makes the act just as binding as if it had been authorized in the first instance.

Cautious Check Cashing

There are two kindred ways of getting the worst of it. One is to hold a fire-cracker too long—until it bursts. The other is to hold a check too long—until the bank on which it was drawn "busts."

When a check is given in payment the Law supposes that the parties have held some such dialogue as this:

Payee: "I'll take this check instead of cash, but it is on condition that the check will be paid when presented. If it is not, I'm coming back for cash."

Maker: "That is all right, with one exception. I'll take the risk of the bank breaking during the time that is reasonably necessary to put the check through in the usual course of banking. But I am not willing that you carry the check around indefinitely in your pocket-book, or stow it away in your safe, and then hold me responsible if the bank goes flooey in the meantime."

Not a syllable of this sort of conversation may have actually occurred. But the Law implies this condition just the same, unless the parties have specially agreed that the check is received as absolute payment, in which case, of course, the payee takes the risk resulting from failure of the bank, regardless of whether the check be presented promptly or dilatorily.

It follows that if the holder of a check would "play safe" against the maker, there should be no unnecessary delay in either presenting the check for payment to the bank on which it is drawn, or in depositing the check in the holder's own bank.

Construction Industry News

Asphalt Institute, New York, has selected Memphis, Tenn., as the meeting place for the Ninth Annual Asphalt Paving Conference on December 1 to 5, inclusive. The Association of Asphalt Paving Technologists will, as usual, meet in conjunction with the Conference. O. L. Kruger, City Commissioner, and W. B. Fowler, City Engineer, of Memphis, are assisting in organizing the committees which will have charge of the local arrangements. An elaborate entertainment program is being planned.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has announced that the sales control of the Allis-Chalmers Model U industrial tractor has been transferred to the company's Monarch Tractors Division at Springfield, Ill. R. W. Gotshall, Springfield Works Sales Manager, and W. Ellzey Brown will have charge of the new industrial line.

Blaw-Knox International Corp., is the new name for the export division of Blaw-Knox Co., Pittsburgh, Penna., which was formerly known as Milliken Bros.-Blaw-Knox Corp. This change in name is due to the larger scope of the company's activities and thoroughly identifies the export company as such. There is no change in personnel and the offices will remain as formerly in the Canadian-Pacific Building, New York City.

Blaw-Knox Co., Pittsburgh, Penna., has announced that William E. Balliet has succeeded P. V. Kelly as Manager of the Birmingham office, with Joseph Riley as Assistant Manager of the district.

Buhl Co., Chicago, Ill., has recently announced the appointment of George C. Theall as Manager of the Eastern District. Mr. Theall will be located in New York City. Another appointment of the Buhl Co. is that of the H. O. Penn Machinery Co., Bronx, New York, as distributors for the Buhl compressor in that district.

Continental Motors Corp., Detroit, Mich., has announced the appointment of W. N. Fitzgerald, Jr., to the Sales Department of the Industrial Division. Mr. Fitzgerald, who has had considerable experience in the field, having been associated with the A. O. Smith Corp., International Harvester Corp., and the Wisconsin Engine Co., began his new duties at once.

John Lauson Manufacturing Co., New Holstein, Wis., has recently reorganized and formed the Lauson Corp., under the laws of Delaware to take over the assets and liabilities of the John Lauson Manufacturing Co. The officers of the new company are F. H. Edson, President; H. N. Edens, Vice President; Clifford O. Piper, Secretary and Treasurer. These three officers and Eugene Wulff and H. Hansen make up the Board of Directors.

G. H. Williams Co., Erie, Penna., has appointed Kratz & McClelland, San Francisco, Calif., as agents for Williams Champion buckets and Arch-Girder trailers.

Sullivan Machinery Co., Chicago, Ill., has appointed as its distributor the Carolina Contractors Equipment & Supply Co., P. O. Box 576, Columbia, S. C.

Hercules Motors Corp., Canton, Ohio, has announced the appointment of Walter F. Radtke as Pacific Coast Sales Representative. Mr. Radtke, who formerly represented Hercules in the mid-continent states, will make his headquarters in Room 601, Russ Building, San Francisco, Calif. Announcement is also made of the opening of an office in Room 733, Mayo Building, Tulsa, Okla., with R. J. Scott, Mid-Continent Sales Representative, in charge.

New distributors recently appointed to handle Hercules products are F. C. Richmond Co., Salt Lake City, Utah, for the Mountain States; Worthington Machinery Corp. of Oklahoma, Tulsa, Okla., for Oklahoma and adjacent territory; Alamo Iron Works, San Antonio, Texas.

Link-Belt Co., 300 West Pershing Road, Chicago, Ill., has recently appointed the following new distributors for its shovel-crane-draglines: W-D-M Equipment Co., Box 329, Columbia, S. C.; Myer & Cunningham, 30 Church St., New York City; Barzee Equipment Co., 1223 Burnet Ave., Syracuse, N. Y.; S. G. Hawkins Co., 723 Washington Ave., Houston, Texas; Lewis-Patten Co., San Antonio, Texas; West Virginia-Kentucky Hardware & Supply Co., Huntington, West. Va.

Chicago Pneumatic Tool Co., 6 East 44th St., New York, recently elected W. L. Lewis, formerly Assistant Comptroller of the Bethlehem Steel Corp., to the position of Vice President, Secretary and Treasurer, to succeed J. G. Grimshaw, who has resigned.

Independent Pneumatic Tool Co., Chicago, Ill., has purchased the Cochise Rock Drill Mfg. Co., Los Angeles, Calif., manufacturers of rock drills and mining tools. The plant of the Cochise Co. will be expanded and operated as a unit of the Independent Pneumatic Tool Co. There will be no change in personnel.

Dirt Moving—the Most Universal of Construction Jobs

Caterpillar Fifteens with Athey 1½-Yard Wagons Hauling Dirt from Steep-Sided Borrow Pits on the State Hospital Job at Holmdel, N. J.

The Bulletin Board

New Lines Carried by Distributors of Construction Equipment

Interstate Machinery & Supply Co., Omaha, Nebr., is now distributing Davenport wagons for the Davenport Locomotive & Manufacturing Co., Davenport, Iowa, and Williams buckets and trailers for the G. H. Williams Co., Erie, Pa.

Dukehart Machinery Co., 106-110 West Second St., Des Moines, Iowa, is now a distributor for Davenport wagons for the Davenport Locomotive & Manufacturing Co., Davenport, Iowa.

Superior Supply Co., 1850 South Kostner Ave., Chicago, Ill., has added the Moritz-Bennett Corp., Effingham, Ill., to its accounts.

E. A. Martin Machinery Co., Joplin, Mo., is now handling Cedar Rapids gravel plants made by the Iowa Manufacturing Co., Cedar Rapids, Iowa.

Brinker Supply Co., Inc., 905 Clark Bldg., Pittsburgh, Penna., has recently added to its accounts the Bates Manufacturing Co., Joliet, Ill.

Smith-Courtney Co., Richmond, Va., is now handling Metalweld Air King compressors, made by Metalweld, Inc., Philadelphia, Pa., and Cleveland rock drills, made by the Cleveland Rock Drill Co., Cleveland, Ohio.

Tractor & Machinery Co., 351 Whitehall St., S.W., Atlanta, Ga., has added Champion rock crushers and asphalt distributors made by Good Roads Machinery Co., Inc., Kennett Square, Pa.; Cleveland rock drills, manufactured by the Cleveland Rock Drill Co., Cleveland, Ohio, and Erie AggreMeter plants made by the Erie Steel Construction Co., Erie, Pa., to its accounts.

Ferris Tractor Co., 3612 Commerce St., Dallas, Texas, has taken on the Monarch tractor made by the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., in addition to the lines formerly handled.

Allegheny Equipment Corp., Grant Bldg., Pittsburgh, Pa., is now distributor for American hoists and derricks, made by the American Hoist & Derrick Co., St. Paul, Minn.; Domestic road, diaphragm and auto-priming centrifugal pumps, made by the Domestic Engine & Pump Co., Shippensburg, Pa.; and Hercules road rollers, manufactured by the Hercules Co., Marion, Ohio.

Leland Equipment Co., Tulsa and Oklahoma City, Okla., is now representing McKiernan-Terry Corp., New York City; and St. Paul Hydraulic Hoist Manufacturing Co., St. Paul, Minn., in addition to the lines formerly handled.

Western Road Machinery Co., 315 Belmont St., Portland, Ore., has recently taken on the account of the General Excavator Co., Marion, Ohio, and is distributing the General Half-Yard shovel.

Kratz & McClelland, Inc., 522 Bryant St., San Francisco, Calif., has recently added to its line Williams heavy-duty trailers manufactured by the G. H. Williams Co., Erie, Pa.

H. W. Moore Equipment Co., 6th & Acoma Sts., Denver, Colo., is now representing the Butler Bin Co., Waukesha, Wis.

Service Supply Corp., 20th & Venango Sts., Philadelphia, Pa., is now handling Union pile hammers, manufactured by the Union Iron Works, Hoboken, N. J.

C. B. Davis Engineering Co., Brown-Marx Bldg., Birmingham, Ala., is now distributor for Williams buckets, manufactured by the G. H. Williams Co., Erie, Pa.

Hedge & Mattheis Co., 285 Dorchester Ave., Boston, Mass., has recently been appointed to handle the line of trailers manufactured by the G. H. Williams Co., Erie, Pa.

Earle Equipment Co., 6331-51 Tireman Ave., Detroit, Mich., is now a distributor for Rogers Bros. Corp., Albion, Pa.

Boehck Machinery Co., Inc., 2404-06 Clybourn St., Milwaukee, Wis., is distributor for Williams trailers, manufactured by the G. H. Williams Co., Erie, Pa.; and C H & E hoists and pumps, made by the C. H. & E. Manufacturing Co., Division of the National Equipment Corp., Milwuakee, Wis.

Hunter Machinery Co., 221-241 So. Waterman Ave., Detroit, Mich., is the exclusive distributor in Michigan for Leschen cable, made by A. Leschen & Sons Rope Co., St. Louis, Mo.

Holmes-Talcott Co., Hartford, Conn., has recently added to its line Speeder shovels and cranes, made by the Speeder Machinery Co., Cedar Rapids, Iowa, and Highway trailers, product of the Highway Trailer Co., Edgerton, Wis.

Bublitz Machinery Co., 2141 Washington St., Kansas City, Mo., has added the Red Star Products Co., Bedford, Ohio, and the Davenport Locomotive & Manufacturing Co., Davenport, Iowa, to its accounts.

The G. F. Lowe Co., 612 No. Michigan Ave., Chicago, Ill., has recently added the Cleveland Rock Drill Co., Cleveland, Ohio, to its accounts.

Bailey-Treen Machinery Co., Huntington, W. Va., has recently added the W-K-M Co., Inc., Houston, Texas, to its accounts.

A. H. Cox & Co., Inc., 1757 First Avenue South, Seattle, Wash., is now a distributor for Ingersoll-Rand compressors, product of Ingersoll-Rand Co., New York City, and Williams heavy-duty trailers, manufactured by the G. H. Williams Co., Erie, Pa.

Sheehan & Co., El Paso, Texas, has recently been appointed distributor for the Cleveland Rock Drill Co., Cleveland, Ohio.

Inter-State Equipment Co., 1105 So. Main St., Aberdeen, S. D., has recently added the following to its line: Killefer road tools, made by the Killefer Manufacturing Co., Los Angeles, Calif.; Wausau snow plows, Wausau Iron Works, Wausau, Wis.; Euclid scrapers and wagons, manufactured by the Euclid Crane & Hoist Co., Euclid, Ohio; Indiana motor trucks, product of the Indiana Truck Corp., Marion,

Ind.; and Freeman four-wheel drive trucks, made by the Freeman Motor Co., Detroit, Mich.

Tennessee Tractor Co., 123-125 Fourth Ave., N., Nashville, Tenn., has recently added the Iowa Manufacturing Co., Cedar Rapids, Iowa, to its accounts.

Smith Booth Usher Co., 228 Central Ave., Los Angeles, Calif., is now representing the following companies: DeWalt Products Co., Leola, Pa.; Four-Wheel Drive Auto Co., Clintonville, Wis.; MacWhyte Co., Kenosha, Wis.; Indiana Shovel Co., New Castle, Ind.; Jackson Manufacturing Co., Harrisburg, Pa., and Skilsaw, Inc., Chicago, Ill.

Additional information in regard to the lines carried by Distributors may be found in the Directory, pages 143-170 *of this issue of* CONTRACTORS AND ENGINEERS MONTHLY.

Speedy Road Improvements with a New Road Planer

A NEW pneumatic road planer, known as the Pneu-Hydro road conditioner, which will cover 75 to 80 miles a day, and operate at as high as 20 miles an hour if desired, has been developed by the Pneu-Hydro Road Machinery Co., Cadillac, Mich.

In this maintainer all vibration and road shock are absorbed by two sturdy air cylinders making for long life for the truck and equipment and eliminating springs.

Pressure can be applied to either end of the machine independently of the other end, so that it is possible to cut with half of the blade and spread with the other half. The loose material is spread out before reaching the end of the blade, thus leaving no windrow or ridge along the shoulder or center of the road. The adjustment can be made in a few seconds from the driver's seat without stopping the truck. The maintainer does effective work on very low pressure, 20 to 30 pounds being all that is required for ordinary purposes. The average pressure carried in the supply tank is 75 to 80 pounds, this pressure being easily maintained by the accumulators.

By simply giving the valve lever a quarter turn, the operator can raise or lower the blade quickly and easily, action being instantaneous. By loosening 6 bolts the machine can be reversed to any desired position in the plane, so that it is not necessary to drive on the wrong side of the road. Pressure gages on the dash inform the driver at a glance of the pressure being applied.

Steel Forms for Guard Rail Posts

GUARD rail posts for state highways have been the subject of extensive experimentation and engineering consideration, it having been conceded quite generally that some such protection is necessary in certain places. The system and method of guard rail construction, consisting of triangular concrete posts with strong cable strung between them, has been devised by the New York State Highway Department, and to meet the increasing demand for posts of this type the Hotchkiss Products Co., Inc., Binghamton, N. Y., has developed the Hotchkiss guard rail post forms.

This form, triangular in shape, is made of ⅛-inch steel, with a hinged cap that drops back allowing the post to free from the mold readily. The hinge cap is securely fastened while the post is being poured and when this is released the cap turns back and allows the post to drop out of the mold. The form needs no pallet. It can be laid on the ground, a side hill or anywhere as it is self-supported in every way.

Tighter Seal for Blasting Machines

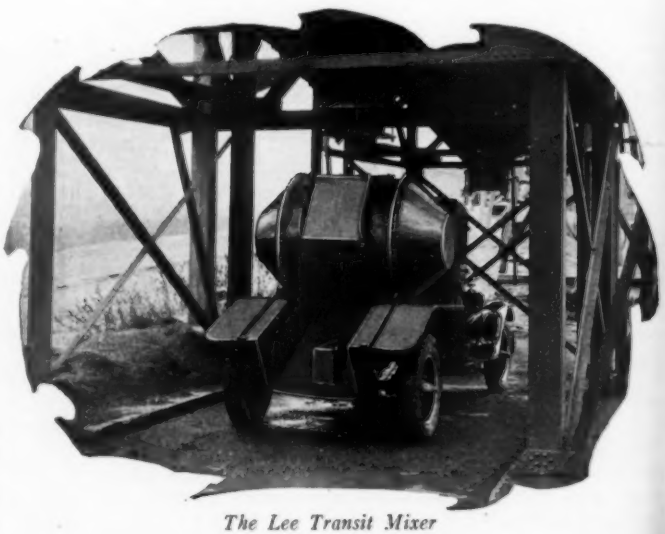
AN improvement on the Hercules Ten Cap blasting machine which makes the machine more moisture and dustproof has been announced by the Explosives Department, Hercules Powder Co., Wilmington, Del. A special rubber gasket which seals case and cover has been developed as regular equipment and can be fitted to machines now in use. The Hercules Ten Cap blasting machine is of the dynamo type and is pocket size.

A 1-Yard Mixer for Use on Any Light Truck

A LIGHT sturdy 1-yard transit concrete mixer which may be attached to any light truck is manufactured by the Lee Transit Mixer Co., Indianapolis, Ind. The unit consists of a 1-yard drum 5 feet long and 3½ feet in diameter, a door 2 x 2 feet for charging and discharging, a dog-snap latch, six finger blades, two 12-pound rail supports running in flanged wheels, sheet metal guards, chute and fenders.

The mixer is easily filled, requiring only a few seconds. A mixture of the correct proportions of sand, gravel, cement and water is dropped in the drum through the door, closing of which seals the charge in the drum. The unit is powered directly from the motor of the truck, the ratio being reduced to a point which practically eliminates any strain on power. The drum rotates four or five times per minute when the truck is operating at 20 miles per hour or the unit may be used as a stationary mixer with a minimum power consumption. Dumping is accomplished by the stopping door on the bottom of the drum while the snapping dog on the door discharges the batch by gravity, completely emptying the drum in from 8 to 10 seconds.

The drum may be quickly removed and used as a bottom-dump bucket in connection with a hoist or derrick, or the entire unit may be removed from the truck chassis by merely detaching the U-bolts which hold it in position. This mixer may be secured as a complete unit, mounted on a truck, chassis, or separately as desired. It is also furnished with a drum of 2-yard capacity or larger.



The Lee Transit Mixer

The New 80-60 Tractor

A New Model Tractor

ANOTHER tractor unit, known as the Cletrac 80-60, with maximum 80 and rated 60 horsepower at the drawbar and covering a wide range of utility in many kinds of work, has recently been announced by the Cleveland Tractor Co., 19321 Euclid Ave., Cleveland, Ohio.

This unit is equipped with a 6-cylinder, 4-cycle, water-cooled valve-in-head, 5½-inch bore, 6½-inch stroke engine. The motor lubrication is force feed to the crankshaft, camshaft, valve rocker shaft, connecting rods and wrist pins and splash system to the cylinder walls. A double oil pump of the gear type assures lubrication on extreme grades. The carburetor and fuel system provides double carburetion, a C fuel pump in conjunction assuring fuel on any grade and a fuel tank with a capacity of 75 gallons. Transmission is of the selective type, three speeds forward and one reverse. Low speed is 1¾ miles per hour, intermediate, 2½ miles per hour, high speed, 3.6 miles and reverse, 2.1 miles per hour at a governed engine speed of 1,000 rmp. Steering is accomplished by the effect of the motor through planetary compensating gears.

The height of the unit is 7 feet, its width over extended axle shaft 8 feet and its length overall 12 feet 8 inches with a 16-inch clearance. Its turning radius is 15 feet. The tracks are 17 inches wide, and the length on the ground for each track is 75 inches, giving a total traction surface of 2,575 inches.

The Cletrac 80-60 may be furnished with a power pulley and take-off as extra equipment. The pulley is 24 inches in diameter, with a 15-inch face and operates at 455 rmp at a belt speed of 2,980 feet per minute and a motor speed of 1,000 rpm. The power take-off operates at 444 rmp and a power take-off transmission can be supplied to give any desired rpm.

New Special Section Grader Blades

TO meet a demand for lower price grader and drag blades without lowering the quality, the Shunk Manufacturing Co., Bucyrus, Ohio, has brought out a special section grader and drag blade. These blades are rolled from the same high quality steel that is used in Shunk's regular blades. However, the special shape and form reduces the weight so that a saving in steel is effected.

Since it is not possible to wear out more than one-half of the cutting edge, the upper half of which must eventually be discarded, a saving is effected by rolling the upper half thinner than the lower half, but still strong enough for the service required. The lower half of this new Shunk section has a much shorter bevel than that furnished on the regular cutting edge and will give longer life. All bolt holes are placed on the thinner or upper half of these sections. The ⅜-inch by ½-inch section offers the wearing surface of a ½-inch blade. The ⅜-inch upper half of the section is equal or superior in strength to a regular ⅜-inch blade. However, it gives the user a wearing surface of a ½-inch blade at a lesser cost.

A Double Drum Builders' Hoist

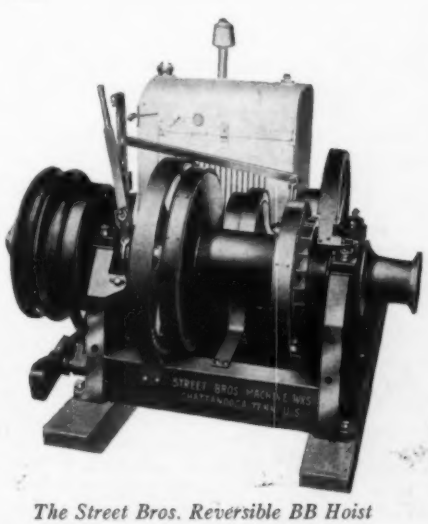
A DOUBLE drum builders' hoist which can be built with or without an elevator sheave is manufactured by Street Bros. Machine Works, Chattanooga, Tenn. The control of this BB hoist is very conveniently arranged, easily operated and very simple. The arrangement of the elevator sheave, drum and winch head gives the operator a clear view of the rope action and enables the winch head to be used without interference.

The frame of the hoist is cast in one piece of the solid web girder type, heavily ribbed and tied by three cross members. A large planed surface is provided for the engine and motor mountings. The drum is independent, 9 inches in diameter by 12 inches long, with flanges 4½ inches deep. The drum friction is of the outside band type, steel band lined with woven asbestos fabric.

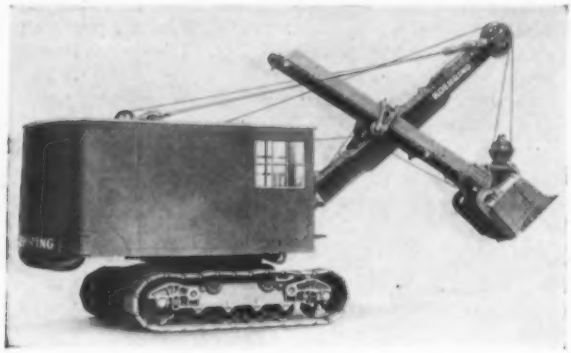
The double elevator sheave, with a large diameter of 20 inches and a small diameter of 16 inches, has an independent band brake and is connected to the drum shaft by a jaw clutch so that it can be disengaged and is held from turning by a pawl pin. The hoist may be used without taking the elevator ropes off. Both the drum and the elevator sheave are provided with band brakes lined with woven asbestos fabric and operated by foot levers. The drum brake is at the opposite end of the drum from the friction and the elevator brake is arranged to hold in both directions.

Reversing is accomplished by having two intermediate shafts extending the full width of the frame. The main gear pinions have the clutch shells cast on and are accurately machined. The reversing gears carry outside band clutches lined with woven asbestos fabric and provided with adjustment screws on the outside. These clutches are engaged by sliding cones operated by a hand lever working in a quadrant with a weighted detent. The intermediate shafts are 1 15/16 inches, drum shafts 2 11/16 inches and the brake shaft 1 11/16 inches in diameter.

Another feature of this hoist is the arrangement of the hoist bed, which is furnished so that a second drum may be added when desired.



The Street Bros. Reversible BB Hoist



The New Koehring Shovel

New Shovel With Enclosed Gears

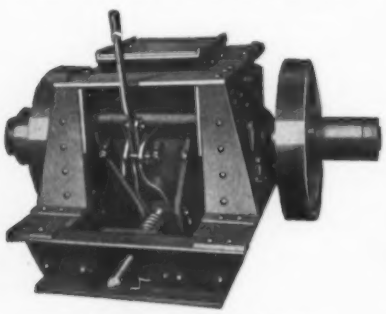
ALL gears except the turntable gear and the swing pinion are enclosed and run in oil on the new Koehring No. 401 1-yard shovel-pullshovel-crane-dragline of the Koehring Div. of the National Equipment Corp., Milwaukee, Wis. All the machinery shafts which enter into the operations of hoisting, drag, dipper crowd, boom hoist and swing are mounted on roller or ball type anti-friction bearings.

By a simple handy quick gear shift this machine has available two speeds for all operations, a high hoist line speed of 206 feet per minute giving fast snappy action to the dipper or a lower line speed of 162 feet per minute which hoists the dipper with either 2 or 3-part cable reeve. A still slower speed for rock work may be had through the use of a different diameter for the drum barrel.

Powered with a 6-cylinder Koehring-Wisconsin gasoline engine which delivers 100 horsepower at 1,075 rpm, the machine has an abundance of reserve power to handle peak loads. When used as a shovel it will handle a 1-yard dipper on 16-foot dipper sticks and equipped for crane work it has a capacity of 13 tons at a radius of 12 feet with a 50 per cent safety factor.

A 6,000-Pound Crusher That Delivers 25 Cubic Yards of Gravel Per Hour

A ROTARY crusher which reduces costs and has an increased capacity and weighs only 6,000 pounds has been announced by the Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, Ill. A conservative rating is from 18 to 25 cubic yards of 1-inch gravel per hour requiring for the crushing only 60 per cent of the power needed by other rock crushers of greater size and less capacity, according to the manufacturer's statement. This Western rotary crusher utilizes a new principle in crushing, an adaptation of the principle that a stone struck with a hammer while it is in the air will break into cubiform pieces following the lines of stratification.



The Western Rotary Crusher

The frame of the Western rotary crusher is built up of structural steel shapes and plates. Within this frame a rotor 20 inches in diameter revolves at a speed of 1,000 rpm. To the rotor are rigidly fastened three steel hammers each 20 inches long which in their rapid whirling barely clear a fixed die that is supported by a heavy casting. These hammers stroke 50 blows per second against the rock as it falls through. The only bearings on the entire machine are the two over-size self-aligning roller bearings supporting the rotor. These bearings are sealed in dustproof housings and require oiling but twice a week. The wear on the hammers and die is taken up by means of shims back of the heavy steel casting which holds the die. No bolt has to be removed or loosened to insert these shims. The die can be replaced by two men in an hour's time and it will take one man only an hour to replace the hammers when such replacements become necessary.

In operation stone is fed into the machine through a 9 x 20-inch opening. The falling stone is caught in mid-air by the revolving hammers which drive the broken cubes for further crushing when necessary between the faces of the hammers and the die.

The New Trackson Crawler Wheels on a Heavy Duty Bottom-Dump Truck

Crawler Wheels for Wagons and Trailers

CRAWLER wheels designed for installation on wagons and trailers, which embody simplicity, durability and smooth-running operation have been announced by the Trackson Co., Milwaukee, Wis. The wheels are built of heavy alloy steel castings and drop forgings to withstand the hard wear and the shock and strains to which equipment of this kind is subject. Each part is generously proportioned to provide a wide margin of safety over the rated load capacities of the wheels.

The tension members or links which hold the shoes in rigid rail position are made of extra heavy drop forgings specially heat treated. These links function simply by moving to and fro within one another without any turning or grinding action. Small parts such as bolts or toggle links are entirely eliminated. The take-up device which provides for tightening the track shoe loop by varying the wheel centers to suit different operating conditions is particularly simple and accessible. Split type hardened steel bushings are used in the shoe hinges of these Trackson crawler wheels. The bushings are pressed into place and keyed in the lugs to prevent turning. They are easily reversible or removable, however, when worn.

These crawler wheels may be installed on almost all makes of wagons. They are manufactured in four sizes with 6, 10, 15 and 20-ton load capacities. The 10 and 15-ton size wheels are of special interest to contractors since they can be used on wagons of from 5 to 10-yard capacities.

A Pneumatic Grinding and Buffing Machine

A SMALL pneumatic grinding and buffing machine which is useful for general light work including the smoothing of flush head rivets and beveling and polishing marble, granite or finishing concrete, is manufactured by the Chicago Pneumatic Tool Co., 6 East 44th St., New York. This No. 10-A Little Giant is now equipped with the closed type pistol grip throttle handle instead of the open type and can also be furnished with the straight type throttle handle as optional equipment.

A Little Giant Pneumatic Grinding and Buffing Machine

The Little Giant has a wheel 4 inches x ¾-inch, a speed of 4,400 rpm, an overall length of 16½ inches and weighs 8¼ pounds.

Automatic Dump Bodies for Ford Trucks

MADE from No. 8 gage roll plate with castings of steel melted in an electric furnace, thus assuring uniformity and highest quality, Penn automatic dump bodies, made by the Hockensmith Wheel & Mine Car Co., Penn, Pa., are well adapted for hard service.

The body is entirely automatic, all operations in dumping the body and returning it to position being controlled from the driver's seat. Installation of the body is simple and quick, the first step being to cut off 27 inches of the extreme rear end of the frame of the truck. Holes 9/16-inch in diameter are then drilled 1⅛ inches from the rear on each side through the bottom and top flanges of the frame. The body is placed in position, located with the steel shim between the body frame and chassis, a wood block filler placed in the channel of the frame at the rear and the bolts inserted.

The tail gate, often the weak part of dump body construction, is made of 8-gage plate, reinforced with structural steel angles, electrically welded or hot riveted in place. The top of the gate is 9 inches above the sides and is hinged on electric steel trunnions. The design of the tail gate and end bracket is such that when the body is dumped, the entire tail gate moves away from the body, instead of simply swinging out, giving a much larger opening through which the load quickly discharges. The gate hangs against the body when it is in loading position, making the latching of the tail gate automatic.

The Penn Automatic Dump Body in Dumping Position

A New Shovel with One-Piece Gear Case

A ONE-PIECE gear case which encloses all of the operating mechanism is a feature of the new Unit 512 designed by the Universal Power Shovel Co., Division of the Unit Corporation of America, Milwaukee, Wis. This one-piece gear case encloses the entire operating mechanism so that it runs in a continuous bath of oil, assuring minimum wear and friction. It also greatly reduces the time necessary for proper lubrication on the older types.

The shovel is equipped with a disc clutch so constructed that it can be adjusted at a single point without the assistance of a wrench. The gears are all drop-forged, double heat-treated and the bores ground true to center. The gears are mounted directly in ball bearings which are in turn mounted in the one-piece transmission case, greatly improving alignment. The shafting in the gear case is splined and full floating, thus equalizing the torque load.

Misalignment is further prevented by the unit mounting of the transmission case and the power plant on the one-piece turntable to form an integral unit. Every control is within easy reach of the operator's seat. A special free working split crowd drum within reach of the driver's seat enables the slack in crowd lines to be taken up in a few seconds. The operator only uses the boom hoist lever and rotates the free-working special split crowd drum. A positive independent forward and reverse crowd, the result of a special crowd line hook-up, assures complete control of the dipper stick.

New Universal Power Shovel

This model is powered with a Waukesha VK motor with governor and the equipment includes an air cleaner, American Bosch magnetos and pusher type fan which ventilates the cab.

Two New Types of Premoulded Expansion Joint for Highways

TWO innovations in premoulded expansion joints have been announced by the Ohio Fibrated Asphalt & Rubber Co., 304 South Dearborn St., Chicago, Illinois. The Ohio expansion joint consists of the center reinforcing and an expansion core which puts resilient strength in the middle of the joint where it is most needed. Upon the resilient core is built on either side layers of heavily saturated asphaltic fiber structure which gives the plasticity element to the expansion joint.

The advantage claimed for this design of expansion joint is that the resilient core of heavily saturated felt readily takes up any expansion and contraction force before the movement of the concrete slabs can cause any flow of the bituminous material. Thus, the center core acts to take up the initial compression or expansion giving time for the outside asphaltic layers to readjust themselves.

The outside layers of the joint have an unusually large asphaltic content, the composition being bituminous material, mineral matter and shoddy textile fibre, so balanced that the composition contains 75 per cent asphalt, approximately 15 to 17 per cent fibre and from 8 to 10 per cent mineral matter.

It is a well known fact that asphalt will penetrate and firmly engage any irregularities in the face of the concrete structure. This property acts for close coherence between the

expansion joint and the concrete structure which preserves the waterproofing qualities or, in other words, the tightness of the joint itself.

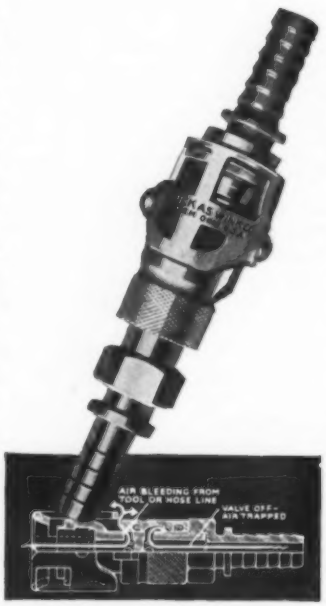
The other joint made of sponge rubber is compressible, plastic and truly elastic. The value of a truly elastic expansion joint is of interest, as it does not ooze or tend to creep out of the crevice, it waterproofs the crevice and, as the material does not flow, it makes a particularly advantageous cushion for the base slab of asphaltic and brick surfaces of concrete foundations.

The use of the sponge rubber joint is not confined to two-layer roads. This joint material is also adapted for use in structures which are exposed to expansion and contraction stresses due to temperature and moisture changes. This material comes moulded to standard sizes, is ready to use and easy to handle.

A New Valve Coupling

A NEW application of the by-pass principle is incorporated in the Quick-As-Wink shut-off valve and coupling recently developed by C. B. Hunt & Son, Salem, Ohio. A ¼-inch push or pull on the outer member is the only movement required to turn the flow of air on or off. In combination with Quick-As-Wink couplings, this new valve allows air to be shut off anywhere on the hose line, automatically bleeding air for the removal of tools for repairs or oiling.

It is claimed that, in spite of the free-swiveling of coupling and valve, they are air tight from 1 ounce to 1,000 pounds pressure. Quick-As-Wink valves and couplings are made in all sizes from ⅛-inch to 4 inches and fit all common types of hose or pipe connections.



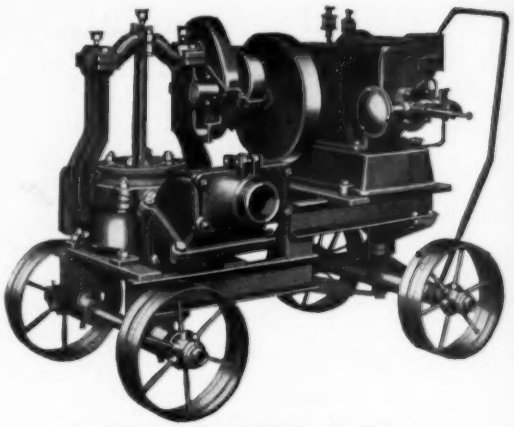
Quick-As-Wink Combination Valve and Coupling

A Closed and Open Discharge Diaphragm Pump

DRAINAGE and emergency pumping call for fast and steady operation of drainage pumps. The new Barnes closed diaphragm pump which may be changed from open discharge to hose discharge in two minutes, has been announced by the Barnes Manufacturing Co., Mansfield, Ohio. With this pump it is possible to spill the water at the pump or discharge it at a distance away from and higher than the pump as the occasion may require.

The threaded discharge outlet for a 4-inch hose coupling is hinged to the open discharge spout. It is held in place when in use by four bolts. For jobs where the open spout is all that is required, the hose outlet is swung back out of the way. It is always conveniently at hand and the change is quickly made.

Instead of spilling mud over the diaphragm to leave a layer of grit in the fold of the diaphragm and the water and its load of mud and sand travels through the suction chamber and out through the discharge valve. With every down stroke the



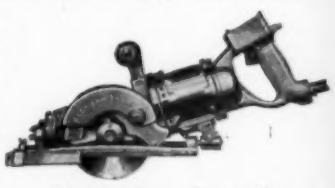
A Barnes Closed Diaphragm Pump

patented bottom plate of the plunger kicks the mud out with the water. To replace the diaphragm it is only necessary to remove the four bolts that hold the divided clamping ring and the four brass cap nuts that clamp the diaphragm to the plunger plate. The special shape of the top plunger plate relieves the diaphragm of pressure on the downstroke. Power transmission from the Fuller & Johnson or LeRoi gas engine is through stub tooth cut steel gears running in a bath of oil. Built as a unit with the pump, the power jack eliminates misalignment. All bearings are adjustable as well as replaceable. The crankshaft and connecting rod bearings are bronze shells heavily shimmed. Both the suction and discharge valves are of the rubber flap type. An easily removed plate gives quick access to the suction valve should it be necessary to remove a piece of wood or other obstructing material drawn through the suction hose. The entire valve can be removed and replaced without disturbing any of the hose connections.

The various models have capacities from 3,000 to 26,000 gallons per hour with a maximum lift of 25 feet and a maximum total head of 35 feet.

A New Portable Electric Saw

THREE sizes of portable electric saws have recently been added to the line of the Van Dorn Electric Tool Co., Cleveland, Ohio, to increase production sawing of all kinds of wood and with the use of an abrasive disc to cut slate, marble, asbestos, tile and similar materials. These saws, which are made in three sizes with the circular saw blade 6, 8 and 10 inches in diameter, are driven by Universal motors operating on A. C. or D. C. and conform to modern safety practices, incorporating an automatic safety switch and automatic telescopic guard. The safety switch starts the saw when the trigger is pulled, but cuts off when the trigger is released while the telescopic guard automatically opens as the saw enters the work and closes over the blade when the cut is finished, affording the utmost protection to the operator.



The Van Dorn Electric Saw

These saws are fully adjustable, having thumb screw adjustments for regulating the depth of the cut, width of cut and a graduated adjustment for beveled cuts at the finger tips of the operator. The depth of the cut is adjustable and the maximum depth of the 6-inch saw is 1¾ inches, of the 8-inch size, 2½ inches and of the 10-inch size, 3½ inches. Each saw is packed in a compact case for carrying to the job.

A New and Smaller Backfiller

THE Model F. Buckeye backfiller has recently been developed by the Buckeye Traction Ditcher Co., Findlay, Ohio, to meet the need of a small machine for refilling both service and small main ditches and trenches. The construction of this machine is simple, all parts or assemblies being easily accessible for adjustment and repair.

Measuring only 69 inches overall in width, without boom, 7 feet 6 inches high and weighing but 4 tons, it is easily and quickly maneuvered in close quarters or transported from one job to another. Its adjustable-length boom has a swinging range of 160 degrees and is easily set in any desired position. The back-action scraper permits the equipment to operate from the spoil-bank side of the trench. Twin Disc clutches control each of the twin full-length, all-steel crawler wheels, enabling the backfiller to turn completely within its own diameter. Traction brakes of ample dimensions permit safe operation on every practical grade. The scraper is all-steel, self-filling and dumping.

The Model F Backfiller

A Compressed Air Spray Painting Outfit

CONTRACTORS everywhere are realizing the benefits of painting with compressed air rather than by the use of hand manipulated brushes. The new Milburn spray which is flexible and can be used as a siphon feed, pressure feed or gravity feed unit, is made by the Alexander Milburn Co., Baltimore, Md. When this gun is used as a siphon feed, a round spray or flat spray up to 8 inches in width is procured and by pressure feed up to 27 inches in width. Either a horizontal or vertical flat spray is obtained by a mere turn of the atomizing head. For dusting, a stream of air devoid of paint particles is obtained by raising a trip lever.

The compressor unit furnished with Milburn sprays represents 73 years of development and is standard equipment in many large industrial, garage and paint spray plants. The compressors are made in various sizes, either electric motor or gas driven to accommodate one, two or three guns. The Milburn Type J-1 unit is complete ready for work and can be hooked up to an ordinary garage air compressor. This unit

The New Milburn Spray Outfit

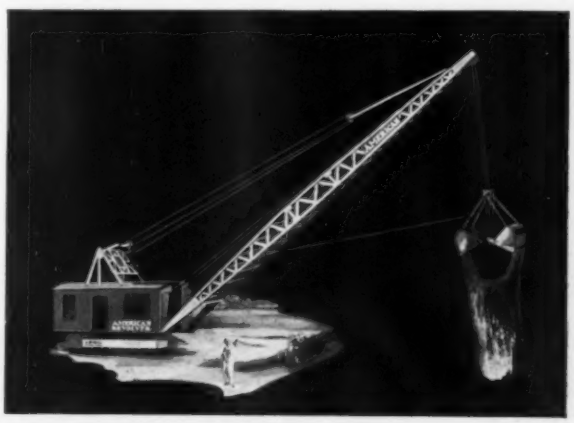
consists of a Type J gun, an air purifier, air regulator and 25 feet of hose.

The Type J-2 unit is a pressure feed outfit, recommended for contractors who wish to paint large areas or for continuous painting. The air pressure is maintained in the paint reservoir and agitates and feeds the paint to the gun in ample volume required for this particular class of work. This outfit consists of a Type J gun, a 5-gallon tank and inner receptacle, regulators for air and paint pressures mounted on the tank head, 25 feet of air hose, 25 feet of paint hose and 50 feet of air hose with connections.

Wide Radius, Broad Gage, Heavy Duty Derrick Crane

AMONG the main features of the new full-circle, long boom, broad gage crane and dragline recently developed by the American Hoist & Derrick Co., St. Paul, Minn., for use in general construction, excavating and sand and gravel quarries, is a combination of the advantages of both derricks and locomotive cranes, the ability to handle heavy working and lifted loads at wide working radius. Other advantages are ease of movement by wheel mounting on track, skid or rollers over rough ground, simplicity of its all-steel construction, stability and ready adaptation to all classes of heavy crane, derrick or dragline work. Either steam, electric, diesel or gasoline power can be furnished.

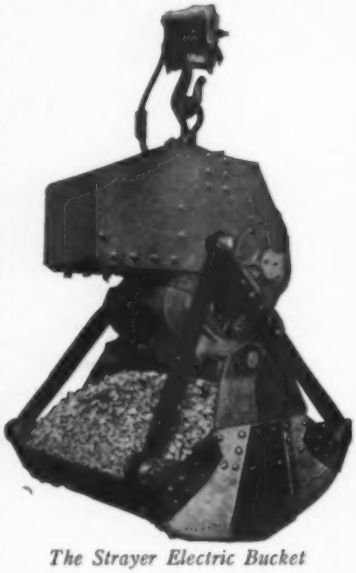
This crane, known as the American Revolver, is available in three sizes with booms 75, 85 or 100 feet long and turntable diameters of either 14 or 20 feet.



The New Heavy Duty American Revolver

A New Electric Bucket

AN addition to equipment in the material handling and distribution fields has recently been made by the Erie Steel Construction Co., Erie, Pa., in a new electric motor-operated power arm type clamshell bucket, known as the Strayer Electric. It is built entirely of steel with heavily reinforced digging scoops to withstand hard continuous service. It successfully handles sand, stone, cement clinkers and similar materials and is manufactured in ¾-yard capacity and up, either A. C. or D. C., for inside or outside work.



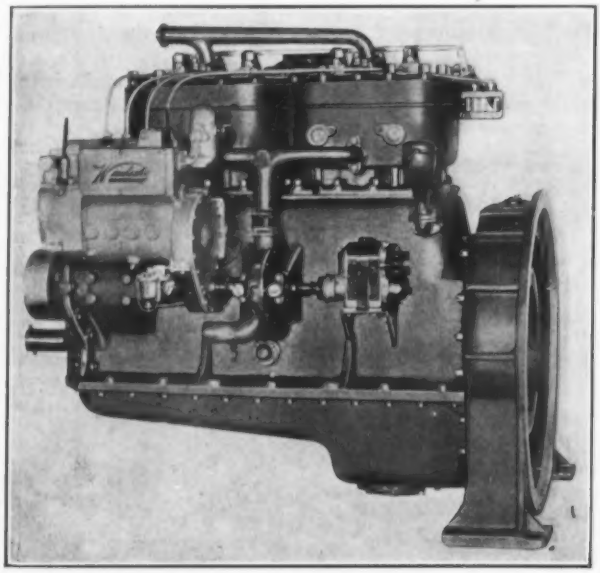
The Strayer Electric Bucket

Among the features of this bucket is the fact that it can be attached or detached in a minute. It works within its own height; it digs as little or much as desired; the whole or any part of the load can be emptied as necessary, and no particular care is needed in controlling the bucket as an automatic feature protects the mechanism. No trip ropes are necessary. It cannot become accidentally discharged and it is impossible to spill the material or open the bucket until the current is applied.

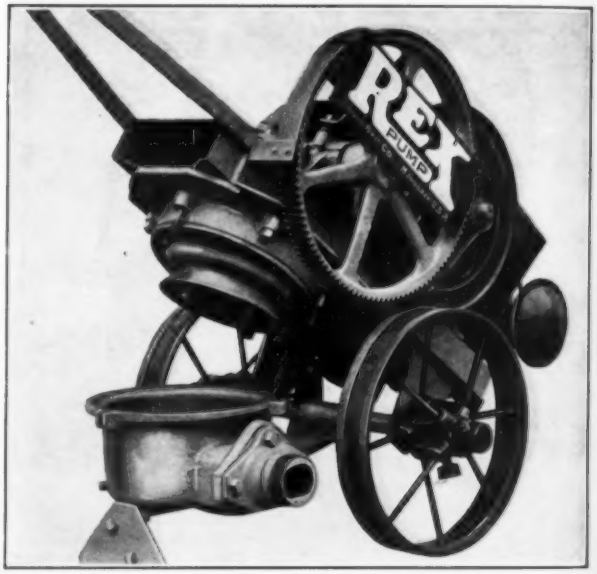
A Medium-Size Low Horsepower Diesel Engine

A WIDE spread interest is being shown in diesel engines for industrial and stand-by power in moderate sizes and in lower horsepower ranges. The Waukesha diesel engine, made by the Waukesha Motor Co., Waukesha, Wis., is simple and easy to start. In the 100-horsepower size an ordinary hand crank or electric starter can be used. It starts as a gasoline engine with a gasoline carburetor and can be run on gasoline at low output indefinitely or can be switched instantly to diesel fuel on a full diesel cycle. Operating speeds common to gasoline engines of this size and type and to electric motor speeds have been retained, giving the engine a wide range of utility for stand-by pumping and electric generator operation, as well as many industrial machinery applications. For installation in temporary buildings during cold weather, the easy starting features are important.

Another recent development of this company is the 6-cylinder engines of 160 to 250 horsepower for use with gasoline, natural, artificial or casing head gas. This engine comes fully equipped with compressed air starter, Waukesha compensated Gas-power fuel mixer, air cleaner, oil cleaner, clutches, couplings, pulley shaft, bearings and all necessary accessories for operation. It is a 7-inch bore by 8½-inch stroke engine which can be cooled by radiator, tank or cooling tower and is designed for continuous full load duty, as well as stand-by use. Small municipal lighting and pumping installations can be handled by this engine with great economy because of its low first cost, high fuel efficiency and low maintenance.



The New 100-Horsepower Waukesha Diesel Engine



The New 3-Inch Chain Belt Diaphragm Pump

Two New Pumps—a 3-Inch Diaphragm and a 2-Inch Centrifugal

FOR all-purpose dewatering the Chain Belt Co., 767 Park St., Milwaukee, Wis., has developed a new 3-inch diaphragm pump. This new pump measures only 30 inches high, 29 inches wide and 42 inches long and weighs only 525 pounds. The engine is completely encased in a dustproof case and is self-oiling. The diaphragm can be changed in 9 minutes by simply tilting back the counterbalanced frame, exposing the diaphragm for easy change.

The new Rex Water Boy pump is a 2-inch centrifugal weighing only 300 pounds and mounted on a wheelbarrow frame, so that one man can move and place it anywhere. The manufacturer claims that capacities of 4,800 to 9,300 gallons per hour are not at all unusual for this pump. It is automotive in type and completely closed and self-oiling, the engine being fully equipped with high tension magneto and other accessories. It is direct-connected through a flexible coupling.

A Sterling Dump Truck Equipped with a Heil Aluminum Body and Hoist

Aluminum Bodies for Dump Trucks

AFTER a thorough study of the applicability of aluminum to dump hauling, dump trucks equipped with aluminum bodies are now being manufactured by the Sterling Motor Truck Co., Milwaukee, Wis. They have been found to be very practical and permit the carrying of greater payloads.

Model DC26, shown in the illustration, weighs 13,300 pounds with an aluminum body as compared to 15,380 pounds total weight when equipped with a steel body. This difference in weight permits carrying an additional ton and still keep within the rated maximum capacity of the truck. This model, with the aluminum body, carries 8 yards of gravel, compared to 7 yards with a steel body. In hauling crushed limestone, it carries 9 yards as compared to 8 yards with a steel body.

The body shown was built by Heil and is also equipped with a Heil hoist, with the subframe, ells, rivets and welding all of aluminum.

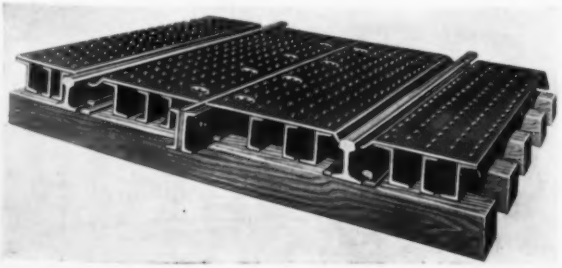
A New Development in All-Steel Highway Crossings

WITH increasing traffic year after year, it has become increasingly important to provide railroad and highway intersections with crossings which will offer a maximum of safety, easy riding and eliminate the necessity of long delays in the installation or repair of such crossings. Joseph T. Ryerson & Sons, Inc., 2558 West 16th St., Chicago, Ill., has recently put on the market a new all-steel highway crossing which offers the features of simple construction, ease of installation, durability and safety.

This new crossing is made of ¼-inch steel plates, firmly riveted to steel channels and zees, a feature of which is its ease of installation. Four men can put in a 8-foot section in less than half an hour and each section is ready for traffic after four simple operations. First the outer plates are secured by placing the ends under the ball of the rail, and locking them to the rail by means of rail clips and anchor rods. The center beam is spiked firmly into the ties. The two center plates are then placed in position by slipping their flangeways under the ball of the rail. The installation is completed by fastening the center plates with locking device which holds the crossing rigidly in place regardless of any traffic strain to which it may be subjected.

Where the installation requires the two rails to be electrically insulated from each other, two rolled steel channels are bolted together with a 1-inch creosoted wood strip in between. The bolts are provided with fiber bushings and washers. These bolted channels are then spiked midway between the rails in place of the center I-beam. The ends of the crossing are bent downward to the ground to prevent dangling chains or air hose from catching in the crossing. Ample circulation of air insures against the rotting of the ties.

Several safety features are included in this all-steel crossing which help to prevent accidents. The plates have a tread which prevents skidding. They are on an exact level with the tracks and highway, making the entire crossing a smooth riding surface. During the winter months, while an abundance of snow may be found on the highway, the crossing is usually clear as snow does not tend to cling to the cold steel and is easily blown off.



The Ryerson All-Steel Plates for Railroad Crossings

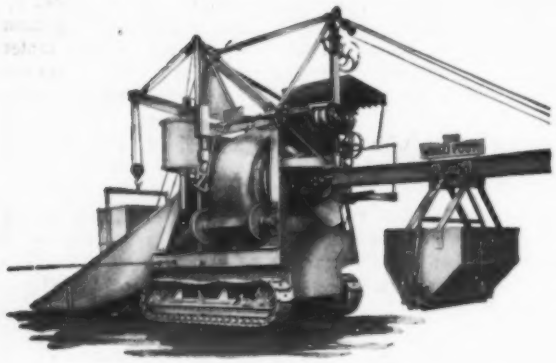
The W-K-M Dragline Excavator Unit Mounted on a Caterpillar Thirty

A Dragline Excavator for Use With Tractor

FOR digging shallow trenches for pipe line work or sewer work, for building irrigation canals or for drainage ditches or wherever a ditch must be dug which would not warrant heavier equipment, a new unit consisting of a W-K-M boom and Williams double arch dragline bucket mounted on a Caterpillar Thirty, which has recently been announced by W-K-M Co., Inc., Houston, Texas, will be found serviceable.

The bucket is the ¼-yard size with digging teeth and works as a dragline with the boom at an angle of approximately 45 degrees. The bucket is loaded on the dragline and swung to either side of the ditch where the load is dropped. The total load, including the bucket, is 2,100 pounds.

A feature of this unit, as in the case of all W-K-M equipment for Caterpillar tractors is that the user may still have his tractor available for all other drawbar jobs.



The MultiFoote 1930 Paver

1930 Paver Model Has Many New Features

THE 1930 model MultiFoote paver made by the Foote Co., Inc., Nunda, N. Y., holds to the same general features of construction of older models, but introduces several new refinements and improvements designed to make it a faster and more dependable machine.

Among these new features are the simple new device for automatically closing the discharge chute when the loading skip is raised to charge the machine, a change in the design of the loading skip which further increases the charging speed and the change from a low pressure to a no pressure water measuring tank.

On the new model all pressure is removed from the water measuring tank which is filled by gravity from an open top auxiliary tank mounted above it on the machine. The flow of water into the auxiliary tank is controlled by a disc type float valve in the supply line. Accurate water measurement under all conditions of grade and regardless of line pressure or air in the supply line is assured and no damage can result from excessive pressure.

A 6-Yard Steel Dump Wagon

A NEW 6-yard dump wagon built entirely of steel and equipped with a track of the 10-ton size, has been placed on the market by LaPlant-Choate Mfg. Co., Inc., Cedar Rapids, Iowa. This wagon comes equipped with either the hand winding or hydraulic door-lifting mechanism and may be used either singly or in trains of two or more. It can turn in its own length and furnishes additional flexibility and hauling equipment when used behind the larger wagons to fill in the gap where two large wagons are too great a load for the tractor and one large wagon does not require all of the tractor's power.

The body of this wagon is built entirely of steel, hot riveting and electric welding being used throughout its construction.

A La Plant-Choate 6-Yard Wagon

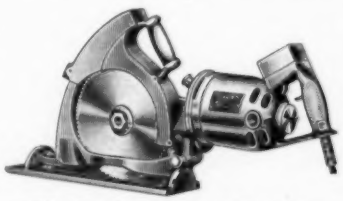
The ¼-inch side body plates are bent at the bottom to form the angle which is fastened directly to the frame, giving the wagon practically one-piece construction.

When equipped with a hydraulic hoist it eliminates the dangerous practice of having a man climb on and off the wagon to wind the doors. By simply shifting a lever convenient to his seat the tractor driver can wind up the doors without even stopping the machine. Power is furnished by a simple rotary gear pump operated off the power take-off of the tractor.

The LaPlant-Choate Road-Layer tracks are the result of many years' experimentation in track design. The track link eliminates the necessity of using trip chains, trusses and intricate working parts. This link is made of one steel casting which forms its own rigid rail for upward pressure and still enables it to follow around the wheels with a minimum of friction due to the lack of wearing parts. The axles used on the 6-yard wagons are heat-treated and hardened steel which give them a longer wearing life and greater strength. The wheel axles on the tracks are 2¾ inches in diameter, while the large heat-treated and hardened steel main axle is 3¾ inches and the stub axle is 3½ inches in diameter.

A New Electric Safety Saw

A RECENT addition to the line of portable electric tools manufactured by the Stanley Electric Tool Co., New Britain, Conn., is that of the Stanley-Crowe safety saw. This portable electric saw is easy to handle and so constructed that the line of cut can be followed without difficulty. All parts are interchangeable so that replacement of worn parts can be made with the minimum of inconvenience.

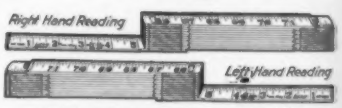


The Stanley-Crowe Safety Saw

This saw is made in four sizes. No. CC7 cuts 2 inches deep, No. CC9 is made with a bevel attachment and cuts 3 inches deep, No. CC12 cuts 4 inches deep and No. CC16, 6 inches deep. Blades of the cross-cut, rip or combination types can be furnished. The depth gage permits cutting to any desired depth and special blades may be secured for cutting soapstone, bakelite, copper, or wall board. Two special saws are made for cutting stone and all models can be furnished with air motors.

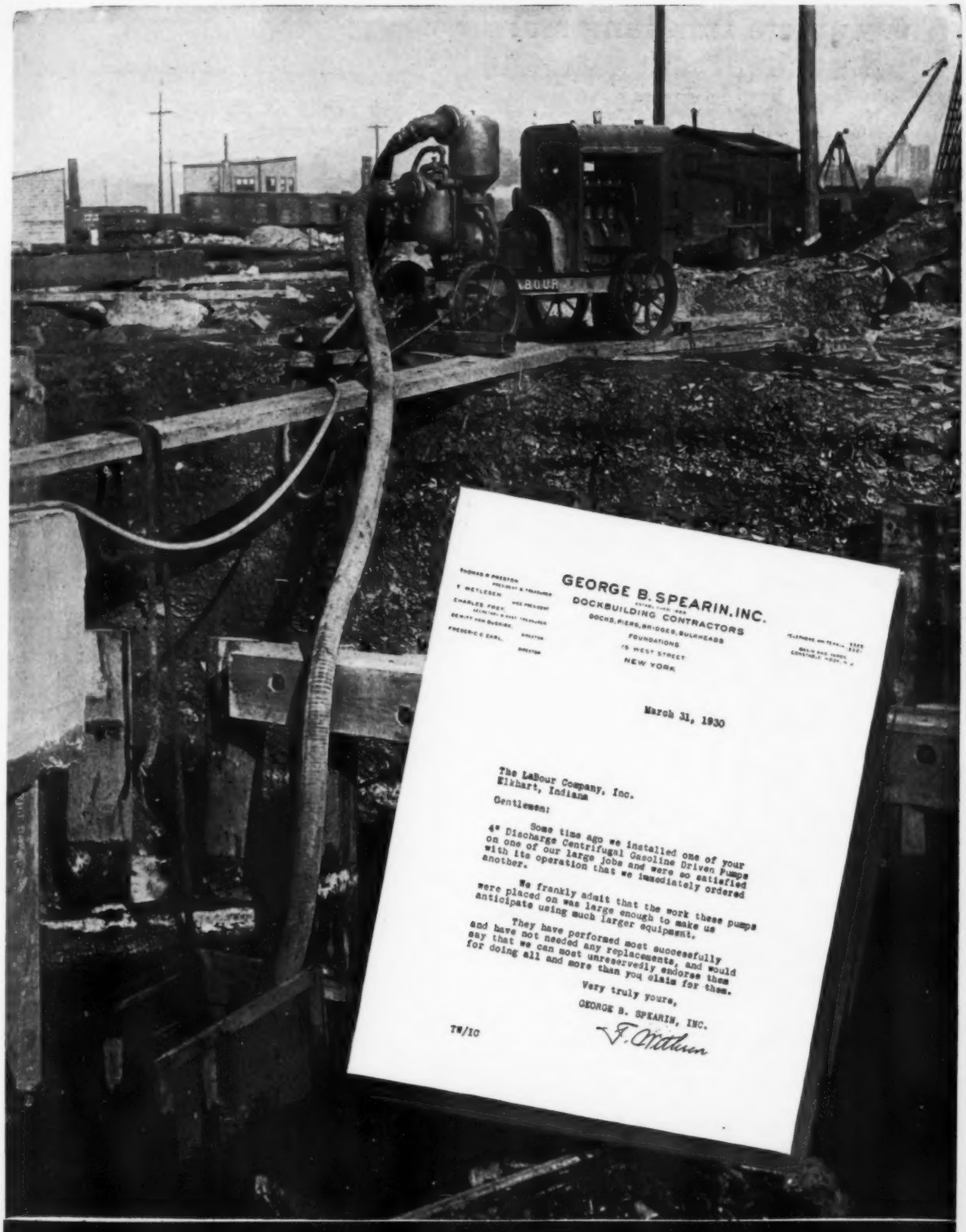
Spring Joint Folding Rule

SEVERAL new and valuable features are included in the new spring joint folding wood rule which has recently been put on the market by the Lufkin Rule Co., Saginaw, Mich. This Two Way-Red End rule has the figures running from left to right on one side and from right to left on the other side. These two features have never before been incorporated in one rule. Right hand is the direction for much common measuring. Left hand is most convenient when the rule is held in the left hand with a pencil or saw in the right. With the Two Way rule the figures are right side up to the user in many measuring operations where heretofore the figures have appeared upside down.



A Two Way-Red End Folding Rule

The rule is made in white enamel finish 5/8-inch wide with 6-inch sections and in 4, 5 and 6-foot lengths. The rules have rust proof metal spring joints and trimmings, strike plates preventing wear of the markings in opening and closing and distinctive bright red ends.


GEORGE B. SPEARIN, INC.
DOCKBUILDING CONTRACTORS
DOCKS, PIERS, BRIDGES, BULKHEADS
FOUNDATIONS
15 WEST STREET
NEW YORK
March 31, 1930
The LaBour Company, Inc.
Elkhart, Indiana
Gentlemen:
Some time ago we installed one of your 4" Discharge Centrifugal Gasoline Driven Pumps on one of our large jobs and were so satisfied with its operation that we immediately ordered another.
We frankly admit that the work these pumps were placed on was large enough to make us anticipate using much larger equipment.
They have performed most successfully and have not needed any replacements, and would say that we can most unreservedly endorse them for doing all and more than you claim for them.
Very truly yours,
GEORGE B. SPEARIN, INC.
TB/IC

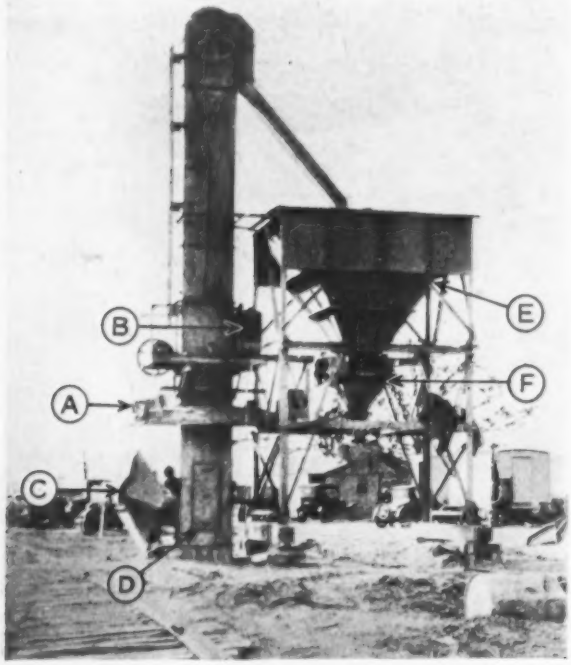
LA BOUR PUMPS

NEVER LAY DOWN ON THE JOB

A Complete Handling and Batching Plant for Bulk Cement

IN order to enable contractors interested in the handling and batching of bulk cement for road paving and for central mixing to secure the price benefit of buying cement in bulk, Blaw-Knox Co., 2067 Farmers Bank Bldg., Pittsburgh, Penna., has recently announced a complete plant arrangement, variable as to capacity and with a conveyor discharge for special cement cars if desired.

The plant is made up of the following units, shown in the accompanying illustration: a power shovel (A) driven by a 15-horsepower gasoline engine (B) removes the cement from railroad cars and deposits it into a folding boot extension (C) which empties into the bottom of the vertical elevator (D) which discharges into a 21-ton self-cleaning cement bin (E). The weighing batcher (F), an integral part of the steel bin,

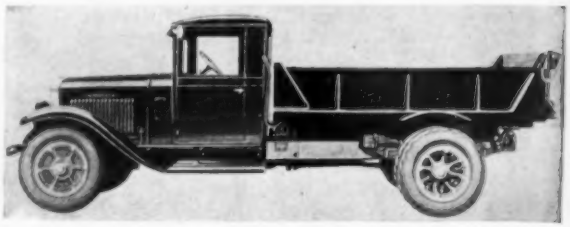


The Blaw-Knox Handling and Batching Plant

receives cement through a series of manually operated gates, whence it is deposited into a 10-inch diameter canvas tube. This tube terminates in a countered sheet metal bell, which spreads the cement on top of a truck load of aggregates.

Two New Truck Models

STYLE in motor trucks is something new, but it is increasingly being demanded by the up-to-date community or contractor. Attractiveness in design, finish and appearance have accordingly received serious consideration in the development of the two new units made by the International Harvester Co. of America, 606 South Michigan Ave., Chicago, Ill., and known as Models W-1 and W-3. This is evidenced especially by the lines of the three-piece hood with its controllable ventilators and the modernly equipped all-steel cab, chromium-plated radiator cover and lamp rims and the attractive colors in which the trucks are finished. The frame, chassis and wheels are finished in red paint, the hood, cowl and cab in gray-green lacquer and the fenders and running



The International 3-Ton Speed Truck with Dump Body

boards in black enamel.

The rated capacities of these new units are 2½ and 3½ tons, respectively. Both trucks are of the double reduction drive type, and are available in five wheel bases, the W-1 from 130 to 200 inches, and the W-3 from 144 to 235 inches.

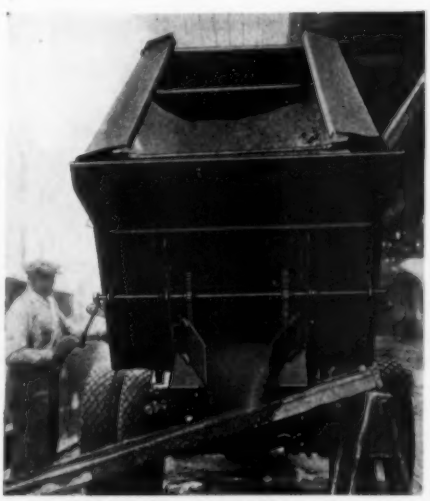
The engines are of the 4-cylinder, valve-in-head type with overhead camshaft and valve mechanism. Each consists of five independently maintained sub-assemblies, which greatly simplify servicing and thus keep the trucks on the job. All parts are easily accessible, making possible a quick check-over.

An unusually strong pressed-steel channel frame designed especially for heavy hauling service, internal expanding four-wheel brakes, a steering column set at an angle that provides maximum foot room for the driver, shatter-proof glass in the rear of the cab and an attractive front bumper are other features of these trucks.

Movable V Concrete Body in New Model

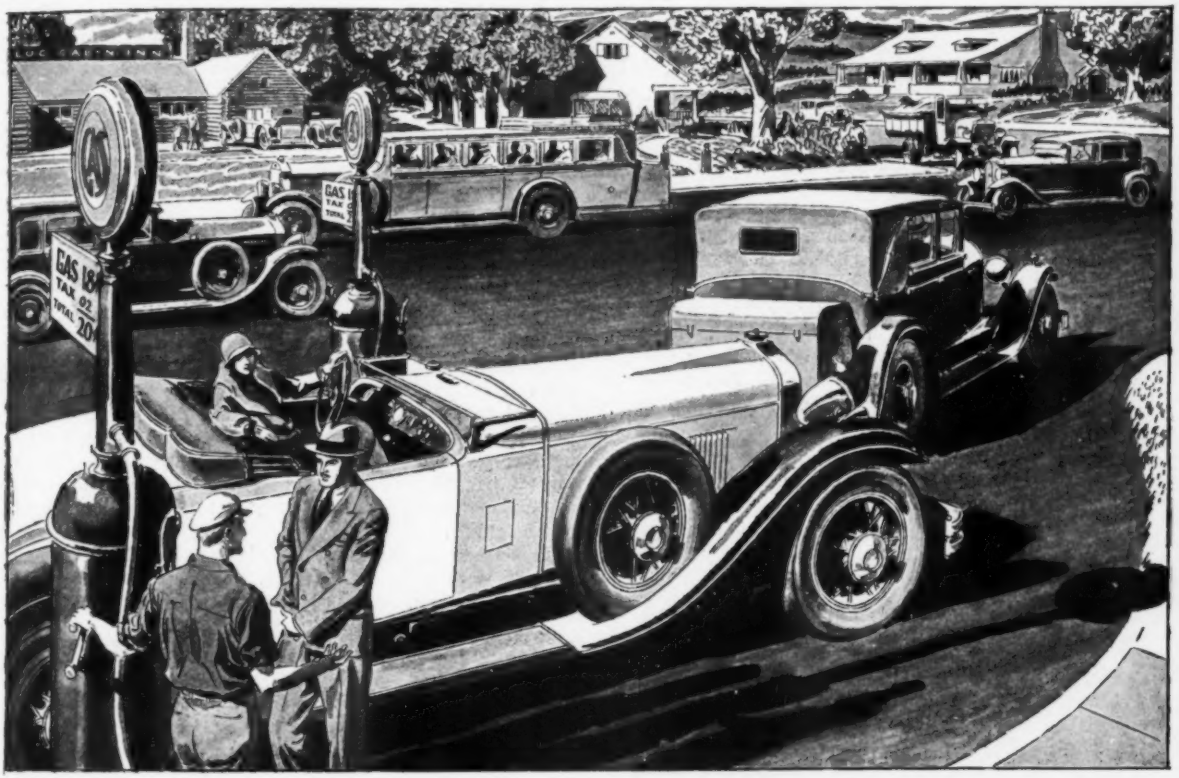
A NEW model of the Bartlett-Snow movable V concrete body has recently been announced by the C. O. Bartlett & Snow Co., 6200 Harvard Ave., Cleveland, Ohio. Concrete is hauled in this body with the side plates in the V position. Arrived at the job, the side plates are spread so that they are vertical before the truck is dumped. This turns the concrete over on itself and corrects any separation that takes place during the haul. In the discharge, the material drops through a constricted rear discharge door and there is further mixing at this point.

The operation of the body is simple. The side plates are moved back and forth by hand through a worm gear mechanism which is designed so that the average truck driver can handle the operation with one hand. The flow of the concrete from the body can be controlled by a slide gate operated through a rack and pinion mechanism.



The Bartlett-Snow Movable V Concrete Body

Roads are bought by the Gallon



If car owners ever nourished the idea that good roads were provided free of charge, the little signs they now see at every filling station, "Gasoline Tax 2 cents" (or more), have set them right.

Now that motorists know who pays, they are displaying more interest than ever in roads. Not a few of them are beginning to wonder if there isn't a practical way to get more roads and wider roads from the money available.

For 26 years, the Tarvia organization has been preaching and practicing the doctrine of "good roads at low cost." Tarvia experience shows where and how to make economies. Tarvia engineers know how to save money by drawing on local materials—by utilizing old roads as foundations for modern, hard-surfaced highways.

The Tarvia field man will be glad to furnish full details. 'Phone, wire or write our nearest office.

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Tarvia
GOOD ROADS at LOW COST

A Heavy Duty Track-Type Tractor

UNUSUALLY high road clearance, low upkeep cost and accessibility of all parts are features which make the Allis-Chalmers Monarch 75 track-type tractor, made by the Allis-Chalmers Mfg. Co., Monarch Tractors Div., Milwaukee, Wis., of particular interest to contractors.

One of its important features is the final drive which is by means of a roller chain, running over cut steel sprockets, and enclosed in an oil and dirt-tight housing so that the chain operates in a bath of oil. The drawbar is of the adjustable swinging type carried on a heavy plate which is bolted and braced to the track sprocket shaft brackets and the transmission steel side plates. The rear weight of the tractor is carried on the 4½-inch diameter carbon manganese heat-treated rear sprocket shaft which is supported in heavy brackets attached to the side plates of the main frame.

The engine is a unit designed specially by the Monarch and LeRoi engineers, one of its important features being the aluminum alloy connecting rods which add efficiency and life because of their strength and light weight. Full force-feed lubrication is employed throughout, the oil being constantly

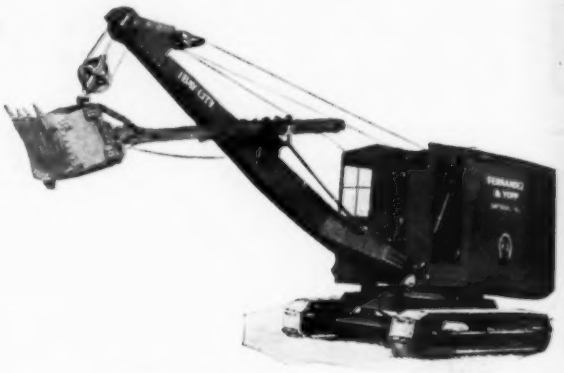
The Monarch-75 Tractor

purified by means of the Purolator. The engine is of the heavy-duty valve-in-head type, the four cylinders cast in pairs being provided with detachable heads. The cooling system consists of the radiator, the fan and the water pump with unusually large passes through the cylinder and cylinder heads.

A New Full Half-Yard Revolving Shovel

A LARGER and heavier machine for contractors requiring increased bucket capacities and greater working ranges has recently been added to the line of shovels manufactured by Bay City Shovels, Inc., Bay City, Mich. This Model K-2, a full half-yard, full revolving convertible shovel, was designed as a companion to the light half-yard Model K. All of the features of Model K have been incorporated in Model K-2, the differences being in the cubical contents of the bucket, the length of the shovel boom and the complete working weight of the machines.

Model K-2 has a working weight of 18 tons, is equipped with a half-yard bucket with manganese front and reversible teeth, an 18-foot shovel boom with 12½-foot dipper sticks and chain type crown. Its crawler treads are 16 inches wide and



Bay City Model K Convertible Shovel

the overall width of the machine is 8 feet 4 inches, with an overall length of 9 inches greater than that of Model K.

The same features and design is used on Model K-2, including an 8-inch center pin, a 71-inch diameter swing roller path, unit cast car body and unit cast machinery frame. Frictionless ball or roller bearings are used on all machine shafts and steering and propelling clutches are located inside the cab. The propelling feature permitting Model K to steer through independent reversible clutches for each crawler, allowing sharp turns to be made by running the crawlers in opposite directions at the same time and independently of each other is also used on Model K-2.

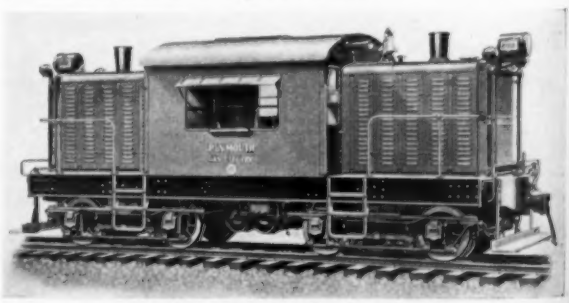
In addition to the shovel attachment, Model K-2 is also available with clamshell, dragline, skimmer, trench hoe and crane attachments.

Gas Electric and Oil Electric Locomotives

A NEW line of gas electric and oil electric locomotives in a full range of sizes from 25 to 60 tons has recently been brought out by Fate-Root-Heath Co., Plymouth Locomotive Works, Plymouth, Ohio.

Model WEL 50-ton gas electric locomotive, shown in the illustration, is 31 feet 4 inches long and 9 feet wide. The frame is built of 15-inch I-beams and 9-inch girder beams, rigidly constructed, with cast steel bumpers and bolsters. Two 4-wheel, spring-equalized trucks permit the locomotive to negotiate sharp curves and ride rough track with ease.

It is equipped with two 6-cylinder engines, one in each end of the locomotive, developing 350 horsepower at 1,000 rpm, and Westinghouse electrical equipment including two 150-kw 500-volt D. C. generators mounted on the base with the engines, and four 110-horsepower motors, two mounted on each truck. The control of the engines, reversing, accelleration and speed control of the locomotive are accomplished from a single operating station. Westinghouse 14 EL straight and automatic air brakes are standard equipment. The locomotive has a tractive force of 33,000 pounds at 2 miles per hour and a maximum speed of 36 miles per hour.



A Plymouth 50-Ton Gasoline Locomotive

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Keep Down *the* Detour Signs . .

GENUINE OPEN HEARTH IRON
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PURE IRON - COPPER ALLOY
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(Meet copper-bearing pure iron requirements in all accepted specifications for corrugated metal culverts.)

Corrugated Culverts

Installed Between Sunup and Sundown

KEEP the roads open — lower your drainage costs. In addition to unquestioned permanence, GOHI Corrugated Culverts offer the practical advantages of easy handling and quick installation.

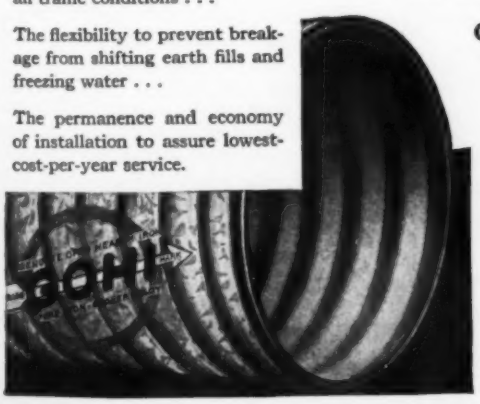
A GOHI Corrugated Culvert may be installed in less time and at lower cost than any other type of culvert. No heavy, expensive machinery needed. No delays. Simply dig the ditch, lay culvert in position, backfill and resurface — the job's done. Quick, Sure, Safe.

GOHI Corrugated Culverts are made of Genuine Open Hearth Iron, pure iron-copper alloy. Metallurgical tests and more than twenty years of actual service prove that this material offers greater resistance to corrosion than any present-day culvert metal. Get all the facts — figure all the costs — you'll specify GOHI Corrugated Culverts.

GOHI Corrugated Culverts have the strength to stand up under all traffic conditions . . .

The flexibility to prevent breakage from shifting earth fills and freezing water . . .

The permanence and economy of installation to assure lowest-cost-per-year service.



GOHI CULVERT MANUFACTURERS, Inc., Newport, Ky.

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The Newport Culvert Co.
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Roanoke Sales Corp.
Roanoke, Va.

St. Paul Corrugating Co.
St. Paul, Minn.

Tennison Brothers
Oklahoma City, Okla.

Tennison Brothers
Texarkana, Ark.

Capital City Culvert Co.
Madison, Wis.

A New Steel Drive Chain

A NEW steel drive chain known as Link-Belt Hyper chain has been announced by the Link-Belt Co., Indianapolis, Ind. The chain is made of alloy steel heat treated and uses a new type of pin and cotter. The pins, bushings and holes in the side bars are accurately ground. The cotters are of a special type for which a patent has been applied for, and are so designed as not to work loose when once inserted and swelled into the holes provided in the pins for their reception.

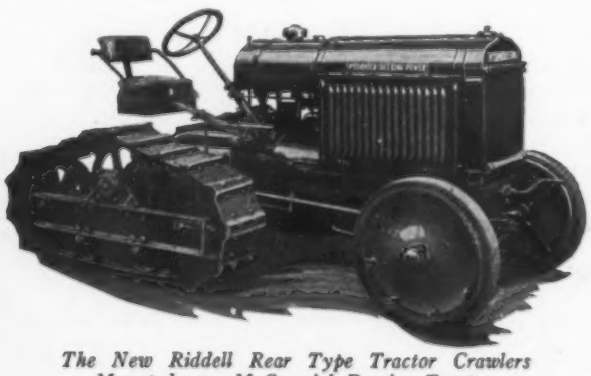
A Link of the Link-Belt Hyper Chain

The Link-Belt Hyper SS-40 chain has an ultimate strength of 75,000 pounds and the Hyper SS-124 chain an ultimate strength of 150,000 pounds. The manufacturing tolerance to which Hyper parts are held are extremely fine, namely 0.001-inch which insures press fits of the highest order and such fits result in a durable chain. The chain has been developed particularly to meet the demand for a stronger and more durable type of chain for heavy positive power transmission.

New Rear Type Tractor Crawlers

FOR many years rear type crawlers mounted upon tractors for various industrial purposes have been increasing in use. The W. A. Riddell Co., Bucyrus, Ohio, has recently announced refinements in the Model TG rear type crawler intended for use on McCormick-Deering 10-20 industrial tractors. These new crawlers are full ball and roller bearing equipped and are mounted upon the same tractor rear axle as the rubber-tired wheels so that the change from one type of mounting to the other can be made in a short period.

These crawlers are particularly valuable when used on power graders, bulldozers or in any service where the tractor must be maintained on an even keel or where a cutting blade is required to cut to close limits.



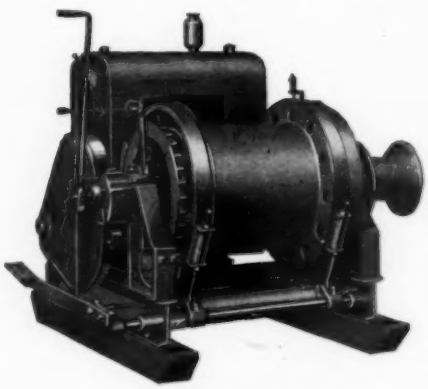
The New Riddell Rear Type Tractor Crawlers Mounted on a McCormick-Deering Tractor

A New Hoist for Bucket and Elevator Handling

A NEW Hi-Speed hoist built for faster bucket and elevator handling and giving speed in the lifting of mortar, bricks and other materials on building construction jobs, has been announced by the Novo Engine Co., Lansing, Mich., in its new single, double and triple drum hoist, all powered with Novo engines.

On the single drum hoist the extra large drum takes in and lets out the cable at higher speeds, making possible more loads per hour, and the wider drum winding reduces cable wear. The drum has double brakes, one on either end of the drum with friction blocks of a special asbestos composition giving the operator full control of the load.

The single and multiple drum hoists are powered with Novo 4-cylinder engines which have ample reserve power so that it is not necessary to hold the load with the brake and speed up the engine to go the last few feet. Novite, a new alloy iron, obtained by the addition of nickel, is used in the side frame, gears and ratchet. This new metal is harder, closer grained and stronger than ordinary cast iron. As a further safeguard against undue wear and to insure continued smooth operation, all drum gear faces are 3½ inches wide. The bases of the Novo WH hoists are electric welded channels with welded-in tubular cross members.



The Hi-Speed Hoist

A New Five-Speed Transmission

FOR use in road builders' and contractors' dump trucks of 3 and 4-ton capacities, Fuller & Sons Mfg. Co., Division of the Unit Corporation of America, Milwaukee, Wis., has developed a new 5-speed transmission.

Two sets of gear ratios are available in this new transmission, an overdrive unit, Model VUOG, and a straight 5-speed reduction, Model VU. A high and low reverse speed is standard equipment in both models. Only one shift lever is used to control all seven speeds. First or low speed and high reverse, which are the added speeds over a regular-speed transmission, are latched out so that a driver accustomed to driving a truck with an ordinary 4-speed transmission has only two new positions to learn. All gears and shafts are made from 3½ per cent nickel steel and case hardened. Single row ball bearings are used on both countershaft and main shaft while the spigot or pocket bearing is a double row.

The clutch furnished with this transmission is the new Fuller 8½-inch multiple disc which provides for force feed lubrication of both clutch pilot and throwout bearings. Clutch relining is simplified as the entire set of discs and facings can be withdrawn by removing the front plate which is held in position by six cap screws.

. . . . and all that's needed for the curing job is one man, a spreader, and some Calcium Chloride . . . . . .

Method of curing concrete by the use of Calcium Chloride on the surface or as an admixture are both approved by the United States Bureau of Public Roads.

No big final clean-up is needed where concrete roads are cured with a surface application of Flake Calcium Chloride. After the man with the spreader applies the Flake Calcium Chloride on the surface, this clean white material takes care of itself just as it takes care of the entire curing operation. No need for constant sprinkling and inspection, either.

No wonder Calcium Chloride has been chosen to do the curing job on thousands of miles of the best concrete highways. Besides assuring perfect curing, the Calcium Chloride methods provide advantages that appeal to everyone concerned with a concrete road, from the men who plan and build it to the taxpayers who pay for it and use it.

The full facts are presented in the information which will be furnished by any of the companies sponsoring this advertisement. Write today and ask for booklet 442

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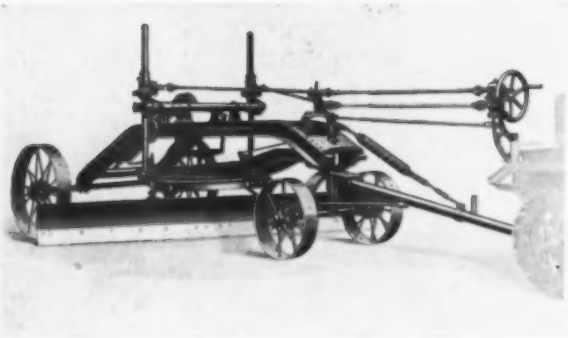

The Caterpillar Fifteen Trailer Patrol

Two New Grading Machines

TWO new one-man-control machines for smoothing roads, shaving off ridges, spreading surface material evenly over the road and filling in hollows, have been announced by the Caterpillar Tractor Co., San Leandro, Calif., in the Twenty Planer and the Fifteen Trailer Patrol.

The Twenty Planer with its seven blades spreads material from the feather edge at the shoulder to the correct thickness in the center of the road. The Fifteen trailer patrol is a broad-bladed grader for maintenance work.

Either machine is controlled by the driver of the Caterpillar tractor who sits on a cushioned side seat so that the controls are easily reached and the operator has a clear vision of the work.

A Motor Truck for Heavy Duty

IN designing the Model 290 Brockway-Indiana motor truck, the Brockway Motor Truck Corp., Cortland, N. Y., has produced a speedy, safe, flexible, easily-handled and controlled unit with a total rated capacity of 30,000 pounds, a power plant that embodies advanced and tested features, and an ample reserve of power to meet emergencies.

The power plant is a 6-cylinder L-head motor with 4¾-inch bore and 5¾-inch stroke, alloy cylinder block and 7-bearing large diameter crankshaft. The large capacity tubular core radiator with aluminum radiator shell is flexibly mounted on the frame which is of heat-treated alloy steel reinforced with heavy steel plate.

The truck is equipped with air brakes on the front and rear wheels, disc type emergency brake mounted on the propeller shaft, semi-elliptic springs, front and two-stage rear, multiple disc clutch, seven-speed selective type transmission mounted amidships and pressure feed lubrication to all important moving parts. The tires are standard 38 x 7-inch pneumatics on the front, with 40 x 14-inch solid tires on the rear.

A Six-Cylinder Model 290 Indiana Truck

A New Line of Gasoline-Driven Locomotives

A NEW line of gasoline engine-driven haulage locomotives which are suitable for industrial service and on construction and excavation projects, has recently been developed by the Midwest Locomotive Works, Hamilton, Ohio. The line, when completed, will include eleven ratings, including 4, 5, 6, 7, 8, 9, 10, 12, 16, 20 and 25 tons respectively. The main features of design and construction are uniform for the line, with variations in the size and weights of parts. They are of the single truck, outside frame type, the one piece frame being made of semi-steel casting.

The wheels are fixed to the axles, the journals as used are equipped with Timken bearings and the trucks can be arranged for various track gages. The weight of the body and frame is carried by heavy semi-elliptical springs which are equalized to cushion the shocks when operating over rough trackage. Service brakes are manually or air operated by levers in the cab.

Two makes of engines are used to power the locomotives, those up to and including 12 tons being equipped with Hercules engines and those of 16-ton or over are powered with

A 16-Ton Gasoline Engine-Driven Locomotive

Climax engines. The drive is through a transmission, giving four speeds forward and four in reverse through clutches and ring gears which drive the sprockets. On sizes of 4 to 16 tons inclusive the front axle is driven by a chain from the rear axle and the 20 and 25-ton models are side rod driven. The reduction from engine speed accomplished by this arrangement gives the locomotive a minimum speed of about 2 mph and a maximum speed of about 12 mph in high gear.

The Midwest multiple disc cork insert type clutch is enclosed and runs in oil and is foot operated. The clutch can be taken down or assembled in a few minutes without disturbing the engine or transmission. Sand boxes are carried under the hood in a separate compartment directly over the exhaust pipe which heats them and keeps the sand dry. The control apparatus clutch, gear shift lever, service brake lever and emergency brake lever are grouped in the cab and located so that the operator has a clear view both front and rear.

The failures of life sit around and complain; the gods haven't treated them white; they've lost their umbrellas whenever it rains, and they haven't their lanterns at night; men tire of failures who fill with their sighs the air of their neighborhoods; there's a man who is greeted with love-lighted eyes—he's the man who delivers the goods.

—FARM MARKET SAYINGS.